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***Observational Study***

**Does ethnicity and education influence preoperative disability and expectations in patients undergoing** **total knee arthroplasty?**

KudibalMT *et al*. Ethnicity and education in TKA patients

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**Abstract  
*AIM***

To investigate if minority ethnicity and duration of education influence preoperative disability and expectations in patients undergoing total knee arthroplasty.

***METHODS***

We prospectively included 829 patients undergoing primary unilateral total knee arthroplasty (TKA) from April 2013 to December 2014 at a single centre. Patients filled in pre-operative questionnaires with information regarding place of birth, duration of education, expectations to outcome of surgery and baseline characteristics. Patients were stratified based on ethnicity. Majority ethnicity defined as born in the study country and minority ethnicity defined as born in all other countries. Similarly, patients were stratified based on duration of education in groups defined as < 9 years, 9-12 years and > 12 years, respectively.

***RESULTS***

We found that 92.2% of patients were of majority ethnicity. 24.5%, 44.8% and 30.8% of patients had an education of < 9 years, 9-12 years and > 12 years, respectively. Mean preoperative (pre-OP) oxford knee score (OKS) in the total population was 23.6. Patients of minority ethnicity had lower mean pre-OP OKS (18.6 *vs* 23.9, *P* < 0.001), higher pain level (VAS 73.0 *vs* 58.7, *P* < 0.001), expected higher levels of post-OP pain (VAS 14.1 *vs* 6.1, *P* = 0.02) and of overall symptoms (VAS 16.6 *vs* 6.4, *P* = 0.006). Patients with education > 12 years had lower mean pre-OP OKS (21.5 *vs* 23.8 and 24.6, *P* < 0.001) and higher pre-OP VAS pain (65.4 *vs* 59.2 and 56.4, *P* < 0.001) compared to groups with shorter education.   
One year post-operatively (post-OP) patients of minority ethnicity had lower mean OKS, higher pain and lower QoL. One year post-OP patients with educations of > 12 years reported higher pain compared to patients with shorter educations. However response-rate was low (44.6%) and therefor post-OP results are not considered significant.

***CONCLUSION***

Minority ethnicity and duration of education influence preoperative disability and expectation in patients undergoing TKA. This should be taken into account when patients are advised pre-operatively.

**Key words:** Socioeconomic factors; Ethnicity; Education; Total knee arthroplasty; Preoperative disability; Expectations to surgery

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**Core tip:** We investigated if minority ethnicity and duration of education influence preoperative disability and expectations in patients undergoing total knee arthroplasty (TKA). We prospectively included 829 patients scheduled to undergo primary TKA in a single centre. We found that patients of minority ethnicity suffer from more severe preoperative (pre-OP) symptoms and expect a poorer post-operative outcome compared to patients of majority ethnicity. We also found that patients with an education of > 12 years have more severe pre-OP symptoms compared to patients with shorter educations. This information can assist surgeons in appropriate treatment plans and pre-OP consultation for all patients.

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**INTRODUCTION**

Worldwide, thousands of patients undergo total knee arthroplasty (TKA) every year and in recent years pre-operative (pre-OP) planning and patient information has been streamlined by using the fast-track concept[1]. The operation has excellent results in terms of survival with a reported 10-year prosthetic survival of close to 95% (National Hospital Discharge Survey 2010); however, patient satisfaction remains a challenge with up to 20% of patients being dissatisfied with their outcome 1 year post-operatively (post-OP)[2,3] .

Outcome is known to be influenced by patient-related factors including age, pre-OP symptoms[4-6], comorbidities and mental health status such as depression and anxiety[7] . Previous studies have shown that patient satisfaction can be influenced by both surgery-related factors such as implant alignment[8-10], implant brand and hospital type[8]  as well as patient-related factors including age, pre-OP symptoms and expectations[2] . Other, less well defined, factors have also been shown to influence outcome following TKA and THA such as socioeconomic factors[11,12] and duration of education[13] . Understanding the way ethnicity and duration of education influence both pre-OP symptoms and post-OP outcome in TKA patients will assist healthcare providers in determining specific areas of possible improvement and to adjust treatment options appropriately. Furthermore, it will assist in more accurate comparison of study populations in future research.

The purpose of the study was to investigate if minority ethnicity and duration of education influence pre-OP disability and expectations in patients undergoing TKA.

**MATERIALS AND METHODS**

We conducted a prospective cohort study including all patients undergoing primary TKA at our institution from April 1st 2013 to December 8th 2014. Exclusion criteria were simultaneous bilateral TKA and missing data on education/country of origin. Prior to surgery patients were asked to fill in a questionnaire regarding patient demographics, pre-OP symptoms and expectations to the surgery outcome. All patients were asked to fill in another questionnaire 1 year post-OP *via* email or regular mail and 370 patients completed a 1-year follow-up questionnaire (Figure 1). A clinical control was not conducted. Patients filled in the questionnaire independently or by help from family members. All surgeries were performed in a standardized fast-track setup[1]  by experienced surgeons specialized in arthroplasty surgery, each performing > 100 primary TKA’s annually. The standard surgical protocol for TKA included spinal analgesia, standardized fluid management, use of preoperative intravenous tranexamic acid (TXA), preoperative single shot high-dose methylprednisolone[14]  and absence of drains. All TKA’s were performed with a standard medial parapatellar approach without the use of tourniquet, with application of local infiltration analgesia (LIA)[15]  and postoperative compression bandaging[16]. Post-operative opiod sparing pain treatment consisted of celecoxib 200 mg/12 h and paracetamol 1 g/6 h with rescue analgesics [administered if visual analogue scale (VAS) > 50 mm at rest] consisting of oral morphine 10 mg as needed. Physiotherapy was started on the day of surgery and continued until discharge. Rivaroxaban (Bayer, Denmark) was used as oral thromboprophylaxis starting 6 to 8 h postoperatively and continuing daily until discharge[17]. Mechanical thromboprophylaxis and extended oral thromboprophylaxis were not used. Patients were discharged to their own home upon fulfilling functional discharge criteria[18] .

Preoperative disability was measured by Oxford knee score (OKS), self-reported quality of life (QoL)[19] , knee pain during activity measured on VAS as was overall symptoms and expectations. OKS ranges from 0 to 48 with lower numbers indicating more severe symptomatic disease. All VAS scales in this study range from 0 to 100. For pain and symptoms higher values represent the worst condition while high values on the scale for QoL represents the best conditions. Patients were stratified based on duration of education and place of birth. Ethnicity was divided into two groups, majority and minority ethnicity. Majority ethnicity defined as patients born in Denmark (the study country) and minority ethnicity defined as all patients born outside Denmark. As level of education varies between countries, education was stratified based on duration (< 9 years, 9-12 years and > 12 years of education)*.* Preoperatively, we registered baseline-characteristics including alcohol consumption, smoking, BMI and co-morbidity. Comorbidity was registered as heart disease, lung disease, previous stroke, kidney disease, liver disease, diabetes and autoimmune disease. We also registered symptoms (OKS, use of walking aids, walking distance, pain on VAS score during rest and activity) self-reported QoL, and expectations to post-OP symptoms and QoL. Finally we registered self-reported post-OP symptoms and self-reported QoL using the 1-year post-op questionnaire.   
As all our results are based on patient reported outcome measures (PROMs) we take into account the minimally clinical important difference (MCID). For OKS this is acknowledged to be 4-5[20,21] and for VAS scales in knee arthritis patients MCID has been reported to be around 20 points[22].

***Statistical analysis***

All data was processed in R 3.2.2. All measurements were reported as mean with standard deviation (SD) for continues variables and number with percent for categorical variables. Test for association of minority ethnicity with interest variables was done by t-test or for non-normal distributed variables by Wilcoxon sum rank test for continues variables and chi-square or, in cases with expected values below 5, Fishers exact test for categorical variables. Associations between education duration groups and the interest variables was done for continues variables by uni-variable linear regression with TYPE III test or Kruskal-Wallis sum rank test for non-normal distributed variables and for categorical variables chi-square and Fishers exact test. Additionally, to adjust for multiple testing a Bonferroni correction was done for all p-values, the correction scale was given by the number of tests performed within each outcome group listed in the results table. The adjusted *P*-value was calculated by multiplying the original *P*-values by the given scale. *P* < 0.05 was considered significant.

**RESULTS**

We included 894 consecutive and unselected patients undergoing TKA at our institution. Following were excluded: simultaneous bilateral TKA (*n* = 52) and missing data on education/country of origin (*n* = 13), thus leaving 829 patients for analysis.

For the total population mean ± SD at time of surgery was 66.8 (10) years, 63.4% were female and 764 (92.2%) of patients were of majority ethnicity. 24.5% of patients had an education of < 9 years, 44.8% of 9-12 years and 30.8% > 12 years (Table 1). Mean pre-OP OKS (SD) was 23.6 (8).Patients of minority ethnicity were younger compared to patients of majority ethnicity (*P* = 0.009) and had a shorter education (72.3% had an education of 0-9 years while only 20.4% of patients with majority ethnicity had an education of this length (*P* < 0.001) (Table 2). Patients of minority ethnicity had a lower pre-OP OKS (*P* < 0.001), higher knee pain during activity (*P* < 0.001) and a significantly larger proportion were dependent on a walking aid (*P* = 0.026) (Table 2). Furthermore, this patient group had a significantly lower expectation to their post-OP pain during activity (*P* = 0.016) and overall symptoms (*P* = 0.016). Patients with an education of > 12 years were older at time of surgery with a mean age of 67.7 years compared to 64.8 years for patients with an education of 0-9 years (*P* < 0.001). Patients with an education > 12 years reported a lower pre-OP OKS compared to the groups with 9-12 years and < 9 years of education (*P* < 0.001). Concurrent to this, patients with education > 12 years had a higher pre-OP VAS for knee pain during activity compared to the other groups (*P* = 0.002, expectation measures also differed between the education groups (all *P* ≤ 0.008). Women composed a higher proportion of the highly educated group with 73.4% compared to 57.1% and 63.0% in the middle and low education group, respectively (*P* = 0.003) (Table 3).

Response-rate to the post-OP questionnaire was 44.6% (*n* = 370). We found a higher response-rate for patients of majority ethnicity (46.2% *vs* 26.2% for minority ethnicity patients). We also found that responders overall had a longer duration of education, the biggest difference seen in education of 0-9 years (29.2% for non-responders *vs* 18.6% for responders, *P* < 0.001). The responders and non-responders did not statistically significantly differ on other parameters.

Patients of minority ethnicity had significantly lower mean OKS 1 year post-OP compared patients of majority ethnicity (*P* = 0.002). Patients of minority ethnicity also reported higher pain during activity (*P* = 0.001), a significantly lower QoL (*P* = 0.001) and significantly higher overall symptom score (*P* = 0.001) compared to patients of majority ethnicity. Although patients of minority ethnicity had higher post-OP pain we also found a larger difference between pre-OP and post-OP pain compared to patients of majority ethnicity (*P* = 0.049) (Table 2). Patients with educations of > 12 years had significantly higher knee pain post-OP (*P* = 0.006), however also a larger difference between pre-OP and post-OP pain during activity (*P* = 0.069) and QoL (*P* = 0.017) (Table 3).

**DISCUSSION**

In this prospective study, we found that patients of minority ethnicity report more severe pre-OP symptoms (higher OKS and higher overall pain level) and have lower expectations to post-OP outcome compared to patients of majority ethnicity. Patients of minority ethnicity also report more severe symptoms post-OP, however our response rate was too low to regard the results significant. Patients with an education of > 12 years report more severe pre-OP symptoms (OKS and overall pain level) compared to patients with both < 9 years and 9-12 years of educations. Post-OP, we found that patients with an education > 12 years reported higher overall pain.

It is generally acknowledged that patient’s overall health is associated with socioeconomic factors[23] . Recently, Lavernia *et al*[11]  have shown that expectations and knowledge of prosthetic surgery in patients with knee- and hip arthritis depends on ethnicity. The same observation was made by Krupic *et al*[12] , who could show that patients born outside Sweden had a poorer outcome after total hip-replacement than patients born within Sweden. This is concurrent with our results as we find that patients born outside the country have greater preoperative disability (lower OKS and higher VAS for pain). However, the studies describing the correlations between ethnicity and surgery are few and based on short-term observation.

In general, minority groups in western countries are less likely to undergo knee replacement than their locally born counterparts[24-26]. Our data show that patients of minority ethnicity have lower expectations to surgery and suffer from more severe symptoms pre-OP than patients of majority ethnicity. The reason for this difference is unknown but we could speculate that patients of minority ethnicity might seek doctors at a more progressed stage of the disease compared to patients of majority ethnicity because of cultural or language barriers. Shahid *et al*[25]  report that racial disparities in African Americans compared to Caucasian Americans are caused by patient preferences, patients education/knowledge of osteoarthritis (OA) and expectations to post-operative outcome. Minority Americans were found to have lower expectations of the overall effect of OA surgery and higher expectations of post-OP pain[24,27-29]. This supports our findings that patients of minority ethnicity have lower pre-OP expectations. African Americans have been found less knowledgeable regarding OA, to have a lower understanding of the risks and benefits of surgery compared to White Americans[30,31], and to have a lower preference for surgical treatment[25]. This could explain our finding of more severe pre-OP symptoms in patients of minority ethnicity as patient preference has been associated with referral from GP to orthopaedic evaluation in OA patients[25]. Many American based studies report that minorities are more likely to undergo surgery at low volume hospitals and that this is a cause for poorer outcome. This does not apply in Denmark as most patients are treated in the public system and all our data are based on patients treated in one high-volume public institution. Severity of pre-OP symptoms has been shown to influence outcome[4-6]. Although our post-OP response rate was too low to make any conclusions we did find that the overall outcome for patients born outside the country was poorer compared to patients born in the country, which is concurrent with the reporting’s of Krupic *et al*[12] . Similar findings have been reported in American patients where minorities are reported to have a higher post-OP complication rate, mortality and longer hospital stay compared to white Americans[25,26].

Duration of education is key to how individuals seek and handle information[32]  and therefore important with regard to how patients cope with medical treatment. We found that patients with > 12 years of education had more severe pre-OP symptoms than those with shorter educations. This result is not concurrent with findings in previous studies, as these have found more severe symptoms in patients with shorter education: an educational level less than high school in the United States has been associated with greater pre-operative pain and lower function in TKA patients by Lopez-Olivo *et al*[33]  Although we found significant *P*-values for these parameters, the difference on OKS was only 3,2 and 9 on VAS, thus both below MCID and not convincingly clinically relevant. High education has previously been found to be a predictor for better post-OP outcomes by Greene et al. while others report no significance[34] . We found that patients with short educations reported a lower post-OP pain severity (MCID below cut off level), and could find no other significant influence of education on other outcome parameters. Although statistically significant Greene *et al*[13]  also found very small differences that were not clinically relevant and so it is uncertain whether education can be used as an outcome predictor for TKA patients. Combined with our low response rate, no findings regarding education and post-OP outcome were convincing.

Our study has several limitations, as this is a purely descriptive and hypothesis-generating study. External validation is a major limitation for our study as both ethnicity and education differ between countries. Education differs greatly across the world; we have, however, tried to accommodate this by dividing patients into three groups based on number of education years rather than graduated degrees. Ethnic minority groups within a country are of course different across the world, and in this study we try to address the issues that arise in healthcare for people born outside their residential country and not health care behaviour of specific ethnic groups. We believe that our results can attribute to the knowledge base for how to approach racial disparities within a population.

Our results are based on regression analysis adjusting for patient related factors such as gender, smoking, alcohol consumption, co-morbidities, symptoms, self-reported QoL and expectations as shown in tables. Residual confounders include the missing evaluation of radiologic status/alignment. Surgical factors have been shown to influence patient satisfaction in other studies and this is unaccounted for in our study; however, all patients were treated by the same high-volume surgeons in a well-defined fast-track setup with standardized treatment for pain, mobilisation and post-OP care as described in the method section[1]. All treatments in Denmark are free of charge, and therefore socioeconomic factors do not affect the choice of implant in our population. Only 44.6% of patients responded to our post-operative questionnaire and response rate was even lower for patients born outside the country (26.2% *vs* 46.2% for patients born in the country). Therefore we make no conclusions regarding significance of either ethnicity or education on post-OP measurements. In this study we have only evaluated results based on PROMs and not other outcome measures such as length of hospital stay, infection rate or other complication rates.

In conclusion, Minority ethnicity and duration of education influence preoperative disability and expectations in patients undergoing TKA. This should be taken into account when patients are advised pre-operatively.

**ARTICLE HIGHLIGHTS**

***Research background***

The background, present status, and significance of the study should be described in detail.

It is known that patient related factors, socioeconomic factors and education influence patient outcomes in general, however this area is difficult to investigate and thus these factors often remain a confounder in scientific work. These factors are also known to be of significance in patients scheduled to undergo total knee arthroplasty (TKA) and this study provides information regarding the significance of education and ethnicity in theses patients.

***Research motivation***

During recent years a trend towards optimized care, standardized patient evaluations and fast-track surgery has been influencing orthopaedic surgery. Although beneficial in many ways, this concept may not be appropriate for all patients. Level of education and ethnicity is known to influence patients and understanding the significance of these factors in TKA patients will assist healthcare providers in optimizing treatment plans for individual patients.

***Research objectives***

The objectives of this study were to determine if level of education and ethnicity influence the preoperative status of patients undergoing primary TKA as well as the influence on expectations to surgery. The significance of ethnicity and level of education on outcome following TKA is still unsure and should be an objective for future research.

***Research methods***

We prospectively included 829 patients undergoing TKA. Patients filled in pre-operative questionnaires with information regarding place of birth, duration of education, expectations to outcome of surgery and baseline characteristics. Statistical analysis was performed to identify the significance of ethnicity and level of education.

***Research results***

We find that patients undergoing TKA in a country different to where they were born report more severe preoperative symptoms and lower expectations to postoperative outcome. We also found that patients with longer duration of education report more severe pre-operative symptoms. We found that patients of minority ethnicity and education > 12 years had more severe symptoms post-operatively, however due to a low response rate we do not conclude on these results. The significance of ethnicity and education on post-operative results remain to be sufficiently described

***Research conclusions***

Minority ethnicity and duration of education influence preoperative disability and expectations in patients undergoing TKA. Patients undergoing TKA in a country different to where they were born have different need individualised evaluation to accommodate potential differences from the general patient population. Patients of minority ethnicity report more severe pro-operative symptoms before undergoing TKA and lower expectations to post-operative outcome. Patients, with educations longer than 12 years, report more severe symptoms before undergoing TKA. Minority ethnicity and duration of education influence preoperative disability and expectations in patients undergoing TKA. Ethnicity and education influence patient’s perception of disease. Socioeconomic factors should be considered when evaluating patients.

***Research perspectives***

Our study provides knowledge regarding the significance of ethnicity and education on preoperative disability and expectations to outcome. This information is key for health care professionals when evaluating patients prior to TKA, as it allows for identification of individuals who may not be suitable for a standardized information regimen. To investigate the significance of socioeconomic factors on outcome following TKA.

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**Table 1 Characteristics of the total patient population** ***n* (%)**

|  |  |  |
| --- | --- | --- |
|  | **All patients** | |
| Baseline characteristics | | |
| BMI (mean ± SD) | 29.7 ± 5 |  |
| Age (mean ± SD) | 66.8 ± 10 |  |
| Gender  Male  Female | 308 (36.6)  534 (63.4) |  |
| Smoking  Non-smoker  Former smoker  Active smoker | 492 (58.6)  213 (25.4)  134 (16) |  |
| Duration of education More than 12 yr  9-12 yr  0-9 yr | 255 (30.8)  371 (44.8)  203 (24.5) |  |
| Ethnicity  Born in Denmark  Born outside Denmark | 764 (92.2)  65 (7.8) |  |
| Preoperative level of function and symptoms | | |
| Walking aid outside the home: None  One cane  Two canes  Wheeled walker  Do not leave the home | 597 (71.2)  133 (15.9)  34 (4.1)  69 (8.2)  6 (0.7) |  |
| Oxford knee score (mean ± SD) | 23.6 ± 8 |  |
| Knee pain during activity1, median (range) | 63 (0:100) |  |
| Quality of life1, median (range) | 47 (0:100) |  |
| Level of symptoms1, median (range) | 50 (0:100) |  |
| Preoperative expectations | | |
| Knee pain 1 yr after surgery1, median (range) | 2 (0:100) |  |
| Quality of life 1 yr post-op1, median (range) | 94 (0:100) |  |
| Level of symptoms. 1 yr post-op1, median (range) | 3 (0:99) |  |

1Visual analogue scale 0-100. BMI: Body mass index.

**Table 2 Significance of ethnicity *n* (%)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Majority ethnicity** | | | **Minority ethnicity** | | | | ***P* value** |
| Baseline characteristics | | | | | | | | |
| BMI (mean ± SD) | 29.7 ± 5 |  | | 29.9 ± 4 | |  | | 0.702 ± 3.508 |
| Age (mean ± SD) | 67.0 ±10 |  | | 64.0 ± 9 | |  | | 0.009 ± 0.045 |
| Gender  Male  Female | 294 (37.36)  470 (62.64) |  | | 11 (15.22)  54 (84.78) | |  | | < 0.001 (0.004) |
| Smoking  Non-smoker  Former smoker  Active smoker | 430 (56.3)  207 (27.1)  127 (16.6) |  | | 55 (84.6)  4 (6.5)  6 (9.2) | |  | | < 0.001 (< 0.001) |
| Duration of education More than 12 yr  9-12 yr  0-9 yr | 248 (32.5)  369 (47.1)  156 (20.4) |  | | 7 (10.8)  11 (16.9)  47 (72.3) | |  | | < 0.001 (< 0.001) |
| Preoperative level of function and symptoms | | | | | | | | |
| Walking aid outside the home: None  One cane  Two canes  Wheeled walker  Do not leave the home | 556 (72.8)  111(14.9)  30 (3.9)  61 (8)  6 (0.8) | |  | | 34 (52.3)  20 (30.8)  3 (4.6)  8 (12.3)  0 (0) | |  | 0.005 (0.026) |
| Oxford knee score (mean ± SD) | 23.9 ± 7 | |  | | 18.6 ± 8 | |  | < 0.001 (< 0.001) |
| Knee pain during activity1, median (range) | 61.0(0:100) | |  | | 76 (13:100) | |  | < 0.001 (< 0.001) |
| Quality of life before surgery1, median (range) | 47.0 (0:100) | |  | | 38 (0:100) | |  | 0.388 (1.938) |
| Level of symptoms before surgery1, median (range) | 50.0(0:100) | |  | | 61 (0:100) | |  | 0.276 (1.380) |
| Preoperative expectations | | | | | | | | |
| Expectations to knee pain caused by use of hip 1 yr after surgery1, median (range) | 2.0 (0:100) |  | | | 4 (0:99) |  | | 0.005 (0.016) |
| Expectations to quality of life 1 yr after surgery1, median (range) | 94.0 (0:100) |  | | | 92 (0:100) |  | | 0.296 (0.888) |
| Expectations to level of symptoms 1 yr after surgery1, median (range) | 3.0 (0:99) |  | | | 6 (0:99) |  | | 0.005 (0.016) |
| Postoperative level of function and symptoms: (Bonferroni scale 4) | | | | | | | | |
| Oxford knee score, median (range) | 39.0 (3.0:48.0) | |  | | 24.0 (10.0:47.0) |  | | < 0.001 (0.002) |
| Knee pain during act1, median (range) | 18.0 (0.0:100.0) | |  | | 62.0 (5.0:90.0) |  | | < 0.001 (< 0.001) |
| Quality of life1, median (range) | 71.5 (0.0:100.0) | |  | | 40.0 (0.0:95.0) |  | | < 0.001 (0.001) |
| Level of symptoms1, median (range) | 21.0 (0.0:100.0) | |  | | (10.0:90.0) |  | | < 0.001 (0.001) |
| Difference in outcome parameters: (Bonferroni scale 6) | | | | | | | | |
| Difference in Pain1, median (range) | 13.0 (90.0:100.0) |  | | | 47.0 (37.0:90.0) |  | | 0.008 (0.0499) |
| Difference in Quality of life after surgery1, median (range) | 15.0 (100.0:98.0) |  | | | 44.0 (99.0:38.0) |  | | 0.013 (0.078) |
| Difference in level of symptoms1, median (range) | 17 (56.0:100.0) |  | | | 46.0 (36.0:88.0) |  | | 0.299 (1.796) |

1Visual analogue scale 0-100. BMI: Body mass index.

**Table 3 Significance of duration of education *n* (%)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | **Education**  **0-9 yr** | | | | | | **Education**  **9-12 yr** | | | | | **Education  > 12 yr** | | | | | | | ***P* value (adjusted)** | | |
| Baseline characteristics | | | | | | | | | | | | | | | | | | | | | | | |
| BMI, mean ± SD | | | 28.7± 5 | | | | | | 30.0 ± 6 | | | | | | 30.5 ± 5 | | | | | | | < 0.001 (0.007) | |
| Age, mean± SD | | | 64.8 ± 10 | | | | | | 67.8 ± 10 | | | | | | 67.7 ± 11 | | | | | | | < 0.001 (0.005) | |
| Gender  Male  Female | | | 92  163 | | | | (36.1)  (63.9) | | 159  212 | | | (42.9)  (57.1) | | | 54  149 | | | | (26.6)  (73.4) | | | < 0.001 (0.003) | |
| Ethnicity  Majority ethnicity  Minority ethnicity | | | 248  7 | | | | (97.3)  (2.7) | | 360  11 | | | (97)  (3) | | | 156  47 | | | | (76.8)  (23.2) | | | < 0.001 (< 0.001) | |
| Smoking:  Non-smoker  Former smoker  Active smoker | | | 155  74  26 | | | | (60.8)  (29)  (10.2) | | 207  100  64 | | | (55.8)  (27)  (17.3) | | | 123  37  43 | | | | (60.6)  (18.2)  (21.2) | | | 0.003 (0.017) | |
| Preoperative level of function and symptoms | | | | | | | | | | | | | | | | | | | | | | | |
| Walking aid outside the home  None  One cane  Two canes  Wheeled walker   housebound | | | 198  35  11  10  1 | | | | | (77.6)  (13.7)  (4.3)  (3.9)  (0.4) | 273  55  12  27  4 | | | | (73.6)  (14.8)  (3.2)  (7.3)  (1.1) | | | 119  41  10  32  1 | | | (58.6)  (20.2)  (4.9) (15.8)  (0.5) | | | 0.005 (0.002) | |
| Oxford knee score, mean± SD | | | 24.6 ± 8 | | | | | | 23.8 ± 7 | | | | | | | 21.5 ± 8 | | | | | | < 0.001 (< 0.001) | |
| Knee pain during activity1, median (range) | | | 59 | | | | | (0:99) | 63 | | | | (0:100) | | | 67 | | | (6:100) | | | < 0.001 (0.002) | |
| Quality of life before surgery1, median (range) | | | 45 | | | | | (0:100) | 47 | | | | (0:100) | | | 50 | | | (0:100) | | | 0.634 (3.170) | |
| Level of symptoms before surgery1, median (range) | | | 51 | | | | | (0:100) | 50 | | | | (0:100) | | | 50 | | | (0:100) | | | 0.634 (3.171) | |
| Preoperative expectations | | | | | | | | | | | | | | | | | | | | | | | |
| Expectations to knee pain caused by use of hip 1 yr after surgery1, median (range) | | | 4 | | | (0:95) | | | 2 | | | (0:96) | | | 2 | | | | (0:100) | | | 0.003 (0.008) | |
| Expectations to quality of life 1 yr after surgery1, median (range) | | | 90 | | | (0:100) | | | 94 | | | (0:100) | | | 96 | | | | (0:100) | | | < 0.001 (0.002) | |
| Expectations to level of symptoms 1 yr after surgery1, median (range) | | | 4 | | | (0:82) | | | 2 | | | (0:99) | | | 2 | | | | (0:99) | | | < 0.001 (0.001) | |
| Postoperative level of function and symptoms: (Bonferroni scale 4) | | | | | | | | | | | | | | | | | | | | | | | |
| Oxford knee score, median (range) | | 40.0 | | | (8.0:47.0) | | | | 37.0 | | (3.0:48.0) | | | | | | 37.5 | | (7.0:48.0) | | | 0.240 (0.960) | |
| Knee pain during activity, Post-OP1, median (range) | | 12.0 | | | (0.0:90.0) | | | | 20.0 | | (0.0:100.0) | | | | | | 26.0 | | (0.0:97.0) | | | 0.002 (0.006) | |
| Quality of life after surgery1, median (range) | | 77.5 | | | (13.0:98.0) | | | | 70.0 | | (0.0:100.0) | | | | | | 69.0 | | (0.0:100.0) | | | 0.055 (0.219) | |
| Level of symptoms after surgery1, median (range) | | 21.0 | | | (0.0:94.0) | | | | 23.0 | | (0.0:100.0) | | | | | | 31.0 | | (0.0:95.0) | | | 0.182 (0.728) | |
| Difference in outcome parameters: (Bonferroni scale 6) | | | | | | | | | | | | | | | | | | | | | | | |
| Difference in Pain1, median (range) | 8.0 | | | (-11.0:84.0) | | | | | | 15.0 | | | (-90.0:100.0) | | | | | 21.0 | | (-48.0:97.0) | | | 0.012 (0.069) |
| Difference in Quality of life Post-OP1, median (range) | -7.0 | | | (-67.0:95.0) | | | | | | -20.0 | | | (-100.0:98.0) | | | | | -18.0 | | (-99.0:98.0) | | | 0.003 (0.017) |
| Difference in level of symptoms1, median (range) | 15.0 | | | (-14.0:89.0) | | | | | | 17.0 | | | (-56.0:100.0) | | | | | 18.0 | | (-41.0:95.0) | | | 0.532 (3.193) |

1Visual analogue scale 0-100. BMI: Body mass index.

**Figure 1 Flowchart of patient distribution.**