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Comparative Efficacy of an In-Patient Physiotherapy Rehabilitation Programme among individuals from different socioeconomic backgrounds after Total Knee Arthroplasty

Tapas Samanta¹, Lokesh Sharma², Madhusudan Tiwari³

ABSTRACT

Total Knee Arthroplasty (TKA) is indicated for treating chronic refractory joint pain. The most frequent condition for this surgery is knee osteoarthritis (OA). It is the definitive treatment for relieving pain and restoring function in people with moderate to severe knee osteoarthritis for whom medical therapy has failed. It has become the standard of care for patients with end-stage knee OA. From rehabilitative aspect it is important to quickly re-establish knee range of motion (ROM). Socioeconomic background factor of patients also create impact on the recovery of patients.

Purpose of this study was to evaluate the impact of inpatient physiotherapy & rehabilitation program on patients of two different socioeconomic backgrounds i.e. urban & rural.

In the study a total of 60 subjects were included based on inclusion and exclusion criteria and allocated into two groups between the age group of 65-74 years. A common physiotherapy rehabilitation protocol has been applied for both the groups. Both the groups were re-assessed at the end of 5 days in the hospital stay and results obtained in both the groups were compared.

The pre and post intervention pain, ROM, and function within groups and in-between groups had been analysed using pair and unpair t tests based on data presentation. Results had been considered significant at $p \leq 0.05$.

The results of the study had shown that physiotherapy rehabilitation improved pain intensity, knee flexion AROM, and function in patients with Total Knee Arthroplasty (TKA). But the post interventional results had shown that rural participants executed better results than urban.



Keywords: TKA – Total Knee Arthroplasty, OA – Osteoarthritis, AROM – Active Range of Motion, TUG- Timed up and Go Test, NPRS- Numeric Pain Rating Scale.



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INTRODUCTION

Total knee Arthroplasty (TKA) is a common surgical procedure now for patients with knee osteoarthritis (OA). TKA forms an artificial joint, in which the joint surfaces are covered by specially shaped metal and polyethylene. It is widely used in the treatment of excessively worn joint surfaces by osteoarthritis, trauma, age, obesity, rheumatologic disorders and previous cartilage or meniscus surgery (Cetin Isik, Uygur Dasar, et al., 2014). The purpose of TKA is to improve the biomechanics of the knee joint by replacing the damaged joint with a prosthetic implant, realigning of the soft tissues, and eliminating structural and functional deficits. In the urban context, perceptions of personal safety or crime can influence outdoor physical activity. For people in rural communities, defined here as individuals living in rural areas and small towns outside metropolitan or urban or metropolitan or urban-influenced communities access to resources for physical activity is different from that for their urban-dwelling counterparts. Low population density influences the infrastructure for physical activity,

¹PhD Scholar, Mahatma Gandhi Physiotherapy College, Mahatma Gandhi University of Medical Sciences & Technology, Jaipur, India

²Professor, Mahatma Gandhi Physiotherapy College, Mahatma Gandhi University of Medical Sciences & Technology, Jaipur, India

³✉Professor & Principal, Mahatma Gandhi Physiotherapy College, Mahatma Gandhi University of Medical Sciences & Technology, Jaipur, India, madhusudan1977@gmail.com

resulting in a scarcity of built environment characteristics commonly found in urban settings, such as sidewalks, parks, and street connectivity. Proximity to infrastructure such as recreation centres often is reduced, requiring considerable driving distances to access such facilities. The time spent in different types of physical activities also differs across the rural–urban continuum, such as active transportation and occupational activity ([Millward et al., 2011](#)). As such, people living with OA in rural settings may have fewer resources to support physical activity and rehabilitation.

Knee osteoarthritis (OA) is the most common joint disorder affecting the elderly throughout the world. It is a leading cause of disability and has a formidable societal and public health impact. Symptomatic knee OA occurs mostly in 65 years of age or older. The prevalence of knee OA in east Asian countries is as common for the population as the prevalence reported in united states.

In patients PT rehabilitation is essential to minimize disability after TKA surgery ([Weingarten Scott et al., 1994](#)). It is demonstrated that less total cost and a faster rate of functional improvement are noticed following intensive physical therapy delivered earlier after surgery ([Michael C. et al., 1998](#)).

A number of literatures established the efficacy of post-operative rehabilitation programme following TKA. Lin et al (2009) concluded gender does not influence post operative knee function of osteoarthritis patients. They did not include other conditions requiring TKA in their study population. Additionally no outcome parameter has been used to measure the difference in post-operative pain intensity through the course of rehabilitation ([Jin Lin, et al., 2009](#)).

Present study has been designed to compare the effectiveness of a common post-TKA in-patient physiotherapy rehabilitation programme in rural and urban patients in terms of changes in post-operative knee pain intensity, active flexion range of motion and knee function. H.-A. Kim et al. (2008) in an epidemiological study stated that knee osteoarthritis (OA) was prevalent among the elderly in Asian countries; using data from a national registry, it sought to estimate the incidence of TKA by age and sex, and the trend for TKA utilization in south Korea.

Osteoarthritis (OA) is a highly prevalent chronic condition and the leading cause of mobility related disability in older adults worldwide ([Cross M et al., 2014](#)). Weight bearing joints, particularly the knee, are commonly characterized by pain, stiffness, swelling, and limited range of movement ([Allen K D et al., 2015](#)). When conservative management fails to provide pain relief and functional improvement, total knee replacement surgery is an elective surgical option for advanced OA. Despite substantial improvements in physical function and pain relief after total knee arthroplasty (TKA) ([Jones C. Allyson Jones et al., 2012](#)) relatively small improvements are reported with physical activity ([Hammett Thomas et al., 2018](#)) Physical activity has positive impacts on the health of people with OA ([Fernandes Linda et al., 2013](#)) and is recommended as an effective intervention to reduce pain and improve quality of life ([Kolasinski Sharon L. et al., 2020](#)). Discordance between large improvements in pain, function, and health related quality of life and negligible change with physical activity after TKA suggests that activity behaviour does not change with TKA. Prior research highlighted the need for patients' rehabilitation to be supported following TKA ([Webster F. et al., 2015](#)) because barriers to physical activity include the severity of symptoms, perceived ability, and opportunities.

In the urban context, perceptions of personal safety or crime can influence outdoor physical activity. For people in rural communities, defined here as individuals living in rural areas and small towns outside metropolitan or urban or metropolitan or urban-influenced communities access to resources for physical activity is different from that for their urban dwelling counterparts. Proximity to infrastructure such as recreation centres often is reduced, requiring considerable driving distances to access such facilities. The time spent in different types of physical activities also differs across the rural–urban continuum, such as active transportation and occupational activity ([Millward Hugh et al., 2011](#)). As such, people living with OA in rural settings may have fewer resources to support physical activity and rehabilitation.

The literature regarding rehabilitation in rural locales is sparse ([Roots R K et al., 2014](#)), despite approximately 19% of the Canadian general population and 23% of Canadians aged 65 years and older residing

in rural settings. Access to rehabilitation in rural areas is less than that in urban areas in terms of transportation services, treatment options, and rehabilitation personnel. Active living, evolving from the physical activity and health movement, focuses on a broader range of activities and positions those activities as a way of living, incorporating physical activity into daily routines (Sallis James F. et al., 2005). Patients may be given the advice to stay active or to incorporate active living into their lifestyles, but what that means to patients and how they enact it is less clear. Although some health care professionals live in the rural community where they practice and have local knowledge or experience, this is not always the case. Health care professionals need to be cognizant of factors of rural living to be effective in supporting rural residents. Given that rural rehabilitation looks different from that delivered in urban centre, new approaches to delivering services and support need to be identified and tested for feasibility and effectiveness. In keeping with this directive, we developed a practical intervention in which physiotherapists expand their roles beyond the walls of the hospital or clinic to coach patients with OA residing in rural settings to become more active.

This qualitative research is part of a larger study to test the feasibility of remote support of patients to engage in and increase their physical activity as part of their TKA rehabilitation and recovery. Patients with OA are covering from TKA were recruited to participate in a 12-week feasibility intervention consisting of remote, physiotherapist-led coaching support for physical activity behaviours.

It is essential for bridging the gap between surgery and functional independence, though its rationale and impact vary between rural and urban contexts. Due to intense supervision-it will provide the immediate clinical stabilization. Clinical markers (like Range of motion) don't always align with patient-reported satisfaction. Human studies are necessary to understand the what "success" means to the patient, particularly in different cultural and socio-economic contexts. Human studies are required to determine if "one-size-fits-all" rehabilitation protocols are as effective for a farmer in a rural area as they are for an office worker in a city. Human trials are needed to assess long-term adherence and the impact of physiotherapy on daily activity levels, which often remain low despite surgery. In the National Significance, with over 15 crore Indians suffering from knee issues and 4 crore-needing TKA, optimizing rehabilitation is vital for the National economy and healthcare system. Research helps ensure that patients in rural "tier three" government setups receive outcomes comparable to high-end urban hospitals. Data from these studies can guide the development of evidence-based guidelines and better distribution of healthcare resources across diverse regions.

Purpose of the study

In this study, the efficacy of an in-patient physiotherapy rehabilitation programme was compared between rural and urban patients following Total Knee Arthroplasty (TKA). The overall functional outcomes were assessed in terms of pain, range of motion (ROM), and functional mobility. The outcome measures used in this study were the 101-point Numeric Pain Rating Scale (NPRS), universal goniometry, and the Timed Up and Go (TUG) test.

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Objectives of this study was: (i) To compare the effectiveness of in-patient physiotherapy rehabilitation programs on pain, range of motion, and Physical performance in rural and urban patients who have undergone total knee arthroplasty. (ii) To Evaluate the Effectiveness of in-patient Physiotherapy Rehabilitation Programme on pain, range of motion, and Physical performance in rural patients who have undergone total knee arthroplasty. (iii) To Evaluate the Effectiveness of in-patient Physiotherapy Rehabilitation Programme on pain, range of motion, and Physical performance in urban patients who have undergone total knee arthroplasty.

METHODS

Sampling: 60 patients of both groups, Group A (Rural): 30 and Group B (Urban) :30 who had undergone through a Total Knee Arthroplasty (TKA) were selected from Physiotherapy OPD, MG Physiotherapy College and Orthopaedic department, MGMCH, Jaipur, Rajasthan, India.

The design of this study was experimental research design which included two groups, The first group (Group A) and the second group (Group B) were treated with continuous passive movement (CPM), active ROM exercises, strengthening exercises (in progressive manner), bed mobility exercises and Gait training.

Inclusion Criteria: Patient undergone through unilateral Total Knee Arthroplasty (TKA), Patients of both genders between the age group of 65-74 years and Patients from Rural & Urban population were included on the basis of Govt. Id for address proof.

Exclusion Criteria: Patients having history of taking Psychoactive Drugs, neurological diseases, Fracture of the knee complex, Trauma, Heart failure, arrhythmias, ischemic heart diseases and respiratory diseases which may limit participation, Serious visual or auditory impairment, any communication barriers, Knee Subluxation and dislocation, Senile Osteoporosis, any radiating pain, any referred pain, Malignancy were excluded from this study.

Outcome measures for this study were, 101point NPRS (Numerical Pain Rating Scale) for pain measurement, Goniometry for ROM & Timed up and Go Test (TUG) for function.

Procedure: A common post Total Knee Arthroplasty (TKA) physiotherapy rehabilitation protocol has been applied for both the Group-A (Rural) and Group-B (Urban) patient to compare the therapeutic outcome. Interventions were given post-operative day 1-5 in the hospital stay. Both Group A & B will receive continuous passive movement (CPM), active ROM exercises, strengthening exercise (in progressive manner), bed mobility exercises and Gait training.

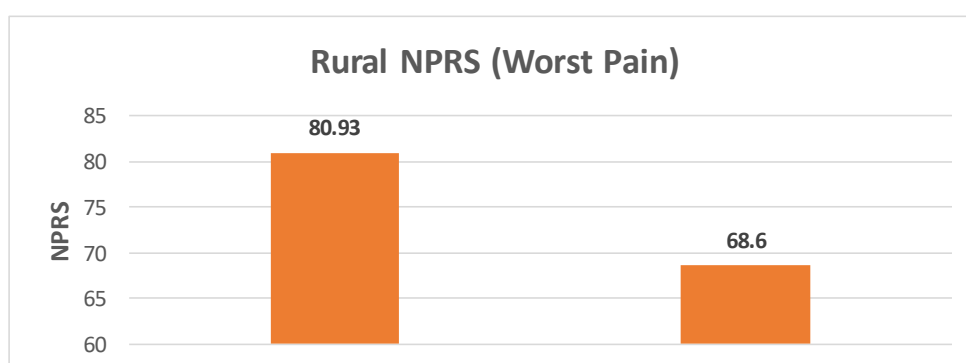
Data Collection: Baseline measurements of the three outcome measures were recorded prior to the application of the intervention protocol. A common post-Total Knee Arthroplasty (TKA) physiotherapy rehabilitation protocol was administered to both Group A (Rural) and Group B (Urban) patients. Both groups were reassessed at the end of the fifth postoperative day during their hospital stay, and the outcomes obtained from both groups were compared.

RESULTS

60 participants recruited in this study were assessed at baseline level and at the end of interventions. Baseline and post intervention pain, ROM and TUG scores were recorded.

Within Group Comparison between baseline and post intervention Scores in Group A(Rural)

Pre and post intervention pain, knee flexion AROM and function were evaluated. The differences between baseline and post intervention pain, knee flexion AROM and functional Scores within Group A were measured by pair t-test / related t-test. The mean values increased from baseline to post intervention for knee flexion AROM and decreased for pain, mobility.



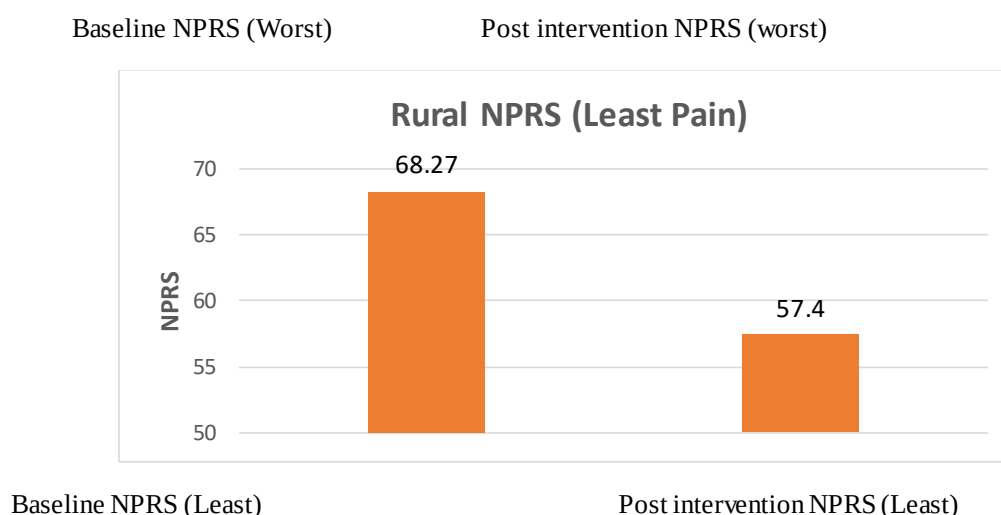


Figure 1. Mean of pre and post intervention 101 NPRS Scores within Group A (Rural)

The Mean value of pre and post intervention 101 NPRS Scores within Group A (Rural), as shown in Figure 1. It illustrates that in least pain, the Mean value decreases from Baseline (68.27) to Post Intervention (57.4) and in worst pain, it decreases from Baseline (80.97) to Post Intervention (68.6). It means that the Mean Value decreases for both the least and worst pain. It proves that in post intervention pain intensity improves (decreased) for all the patients.

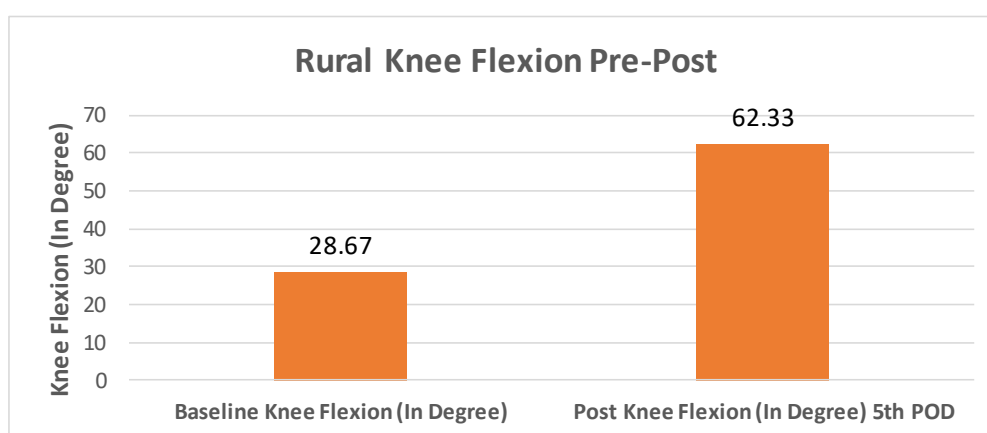


Figure 2. Mean of pre and post intervention knee flexion AROM within Group A (Rural)

The Mean value of pre and post intervention knee flexion AROM within Group A (Rural), as shown in Figure 2. It demonstrates that the Mean Value increases from Baseline Knee Flexion AROM (28.67 degree) to Post Intervention Knee Flexion AROM (62.33). It proves that in post intervention knee flexion AROM have increased for all the patients.

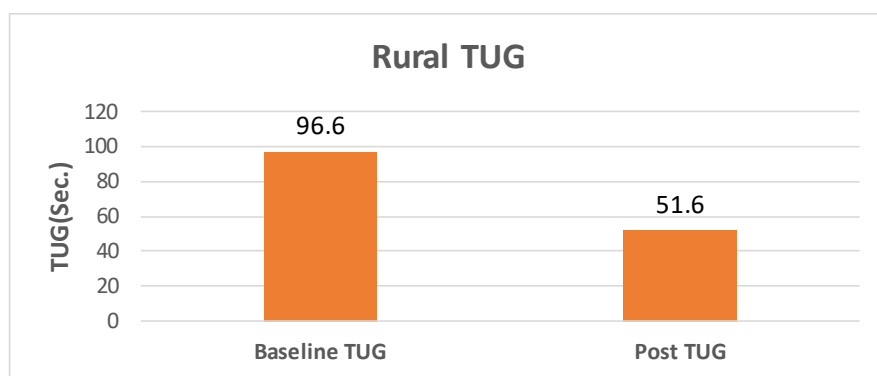


Figure 3. Mean of pre and post intervention TUG scores within Group A (Rural)

The Mean value of pre and post intervention TUG scores within Group A (Rural), as shown in Figure 3. It emphasized that the Mean Value of TUG Score decreased from Pre intervention (Baseline) score (96.6 sec.) to Post Intervention score (51.6). It indicates that the improvement of mobility in Post Intervention for all the patients.

Within group comparison between baseline and post intervention scores in Group B (Urban)

Pre and post intervention pain, ROM and functional scores were measured. The differences between baseline and post intervention pain, AROM and functional scores within group B were measured by pair t-test / related t-test. The mean value increased from baseline to post intervention for AROM and decreased for pain, mobility.

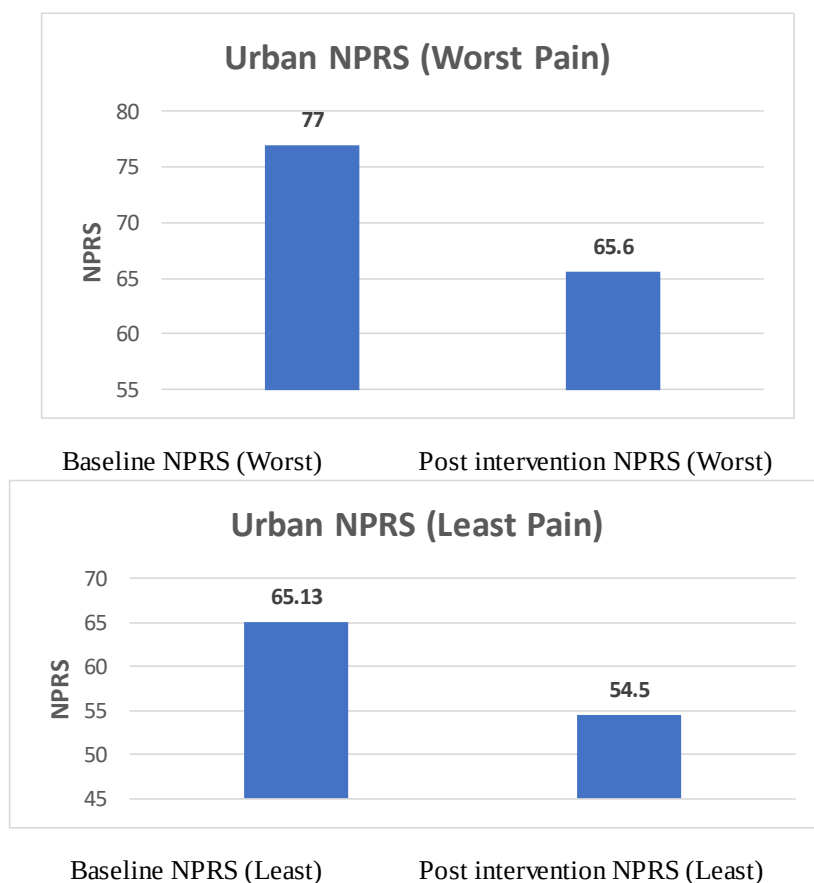


Figure 4. Mean of pre and post intervention 101 NPRS scores within Group B (Urban)

The Mean value of pre and post intervention 101 NPRS Scores within Group B (Urban), as shown in Figure 4. It illustrates that in least pain, the Mean value decreases from Baseline (65.13) to Post Intervention (54.5) and in worst pain, it decreases from Baseline (77) to Post Intervention (65.6). It means that the Mean Value decreases

for both the least and worst pain. It proves that in post intervention pain intensity improves (decreased) for all the patients.

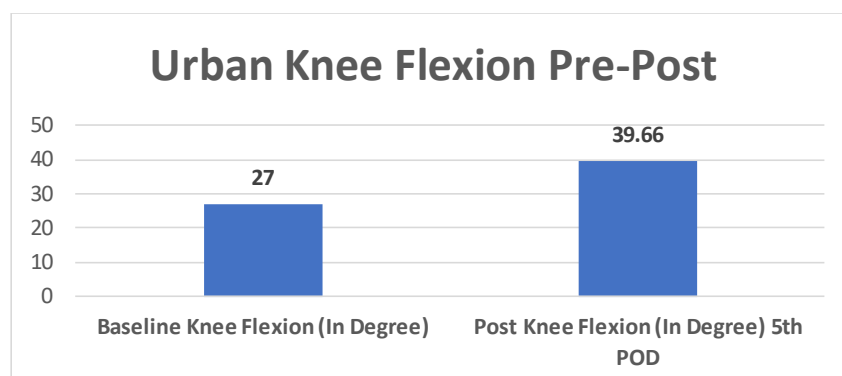


Figure 5. Mean of pre and post intervention knee flexion AROM within Group B (Urban)

The Mean value of pre and post intervention knee flexion AROM within Group B (Urban), as shown in Figure 5. It demonstrates that the Mean Value increases from Baseline Knee Flexion AROM (27 degree) to Post Intervention Knee Flexion AROM (39.66). It proves that in post intervention knee flexion AROM have increased for all the patients.

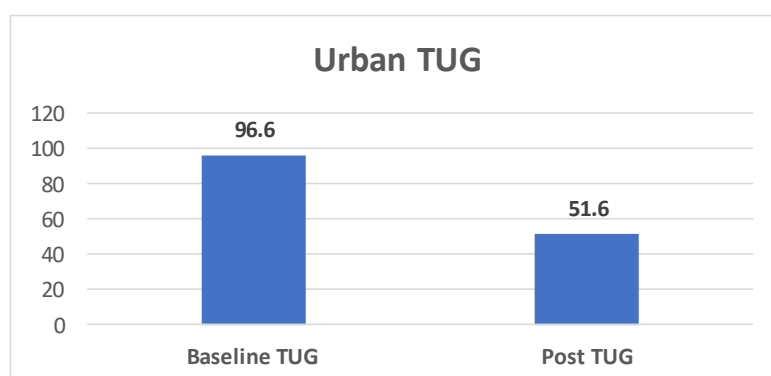


Figure 6. Mean of pre and post intervention TUG scores within Group B (Urban)

The Mean value of pre and post intervention TUG scores within Group B (Urban), as shown in Figure 6. It emphasized that the Mean Value of TUG Score decreased from Pre intervention (Baseline) score (96.6 sec.) to Post Intervention score (51.6). It indicates that the mobility improvement in Post Intervention for all the patients.

Comparison between baseline and post intervention scores of 101 NPRS, Goniometry and TUG scores in between Group A (Rural) and Group B (Urban)

Analysis between groups were done by unpair t-test / unrelated t-test to find out the differences in 101 NPRS (Pain), knee flexion AROM and TUG scores between the groups. The mean value increased from baseline to post intervention for knee flexion AROM and decreased for pain, TUG scores.

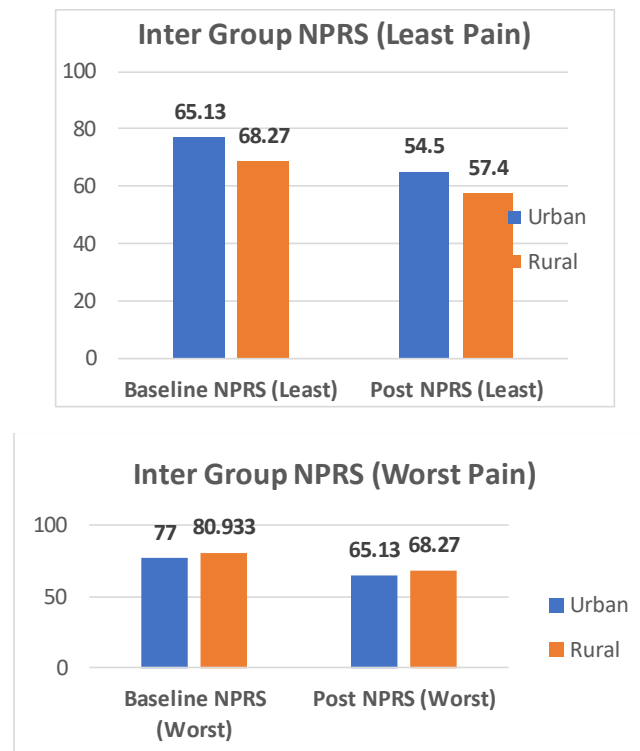


Figure 7. Improvement of 101 NPRS scores in Group A(Rural) and Group B (Urban)

The Mean value of pre and post intervention 101 NPRS Scores in Group A (Rural) and Group B (Urban), as shown in Figure 7. It illustrates that in least pain, the Mean value decreases from Baseline (Rural:68,27 & Urban:65.13) to Post Intervention (Rural:57.4 & Urban:54.5) and in worst pain, it decreases from Baseline (Rural:80.933 & Urban:77) to Post Intervention (Rural:68.27 & Urban:65.13). It means that the Mean Value decreases for both the least and worst pain in intergroup NPRS Score. It proves that in post intervention pain intensity improves (decreased) for all the intergroup patients.

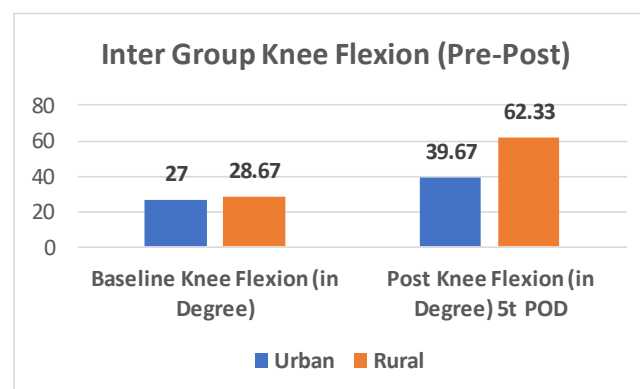


Figure 8. Improvement of knee flexion AROM in Group A (Rural) and Group B (Urban)

The Mean value of pre and post intervention knee flexion AROM in Group A (Rural) Group B (Urban), as shown in Figure 8. It demonstrates that the Mean Value increases from Baseline Knee Flexion AROM (Rural:28.67 degree & Urban:27 degree) to Post Intervention Knee Flexion AROM (Rural:62.33 degree & Urban: 39.67 degree). It proves that in post intervention knee flexion AROM have increased for all the intergroup patients.

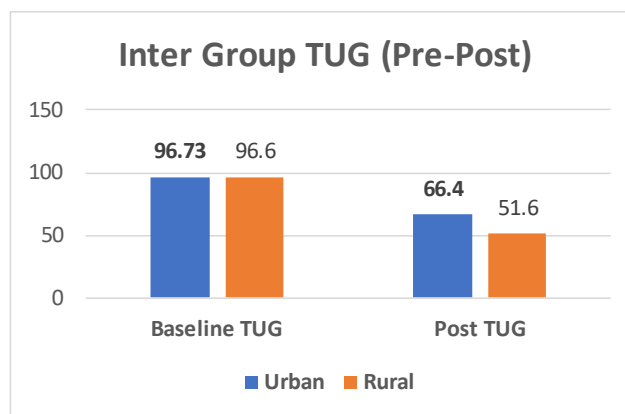


Figure 9. Improvement of TUG scores in Group A (Rural) and Group B (Urban)

The Mean value of pre and post intervention TUG scores in Group A (Rural) and Group B (Urban), as shown in Figure 9. It emphasized that the Mean Value of TUG Score decreased from Pre intervention (Baseline) score (Rural:96.6 sec. & urban:96.73 sec.) to Post Intervention score (Rural:51.6 sec. & Urban:66.4 sec.). It indicates that the mobility improvement in Post Intervention for all the intergroup patients.

DISCUSSION

Within group Analysis: In this study comparing the effectiveness of in-patient physiotherapy rehabilitation programme in-between rural and urban patients after total knee arthroplasty (TKA), it revealed that post TKA rehabilitation programme was effective in decreasing pain intensity, improving knee ROM and function of the patients and the differences within the groups were strongly significant. The overall functional outcome was measured in terms of pain, ROM and functional mobility and the scales used in this study were 101 NPRS, universal goniometer and TUG.

Roos E (2003) opined that the gold standard for achieving functional mobility is early mobilization after arthroplasty. It is possible to improve outcomes related to physical activity by implementing exercise programs carried out at homes or in groups. Knee arthroplasty possibly requires more rehabilitation than other arthroplasty to achieve optimal outcomes ([Morse Janice M. et al., 2015](#)).

Intergroup Analysis: However, the statistics showed significant difference between groups i.e. Group A and Group B. Statistically more significant improvement were exhibited by the subjects of Group A compared to Group B in terms of knee flexion AROM and TUG score but not 101 NPRS. The reason behind statistically insignificant improvement in pain intensity in case of both the groups may be the shorter duration of inpatient physiotherapy program (five days).

We aimed to identify how patients with OA waiting for and recovering from TKA conceptualize and participate in physical activity behaviours in their rural setting and gather perceptions of feasibility of a remotely led physical activity coaching intervention. Despite having different foci in the research questions and data collection guides, we found stakeholder triangulation of some themes across respondent groups. Participants across the stakeholder groups recognized the importance of physical activity for older adults with OA. Participants also identified challenges unique to the rural context for maintaining or increasing physical activity as part of rehabilitation while waiting for or recovering from TKA.

Hansen et al. reported that the physical attributes of the rural environment were noted by all three stakeholder groups as unique facets of rehabilitation in this patient population. The patient and decision maker groups cited challenges with a lack of accessible infrastructure for walking and the long driving distances required to use recreation facilities. However, the patient groups also cited the benefits of rural living as related to physical activity opportunities. They commented on the opportunity for utilitarian physical activity related to their rural living, such as property maintenance, chores, and gardening, which mirrors the findings from the study by ([Hansen Anush Yousefian et al., 2015](#)) that rural adults are more active in household physical activity than urban adults. This was particularly true for the men in our sample; the preference for work- or chore-based

physical activity over social activities, such as walking groups, was the only substantial gender-based difference occurring in participant responses. Patients also commented on enjoying the beauty of natural surroundings while being active in their rural setting. These aspects should not go overlooked when counselling for physical activity behaviours. Harding and colleagues ([Harding Paula A. et al., 2015](#)) interviewed patients post arthroplasty of the hip or knee and reported that participants perceived that regaining physical function allowed them to enjoy living through both physical and social activities. Although action planning should consider the constrained infrastructure resources of a rural setting, the positive aspects of rural living could be highlighted to promote physical activity that patients with OA may view as purposeful or pleasant.

Patients reported receiving guidance on remaining active as they waited for or recovered from TKA. However, more patients in the recovering group than the waiting group cited general understanding of the “active living” term. Therefore, advising patients to take up an active living lifestyle might not resonate the way health professionals intend. An understanding of the living environment of patients and the availability of local resources is necessary to tailor patient education and advice. Within the context of rehabilitation, we echo the rural active living call to action of Umstattd Meyer and colleagues ([Umstattd Meyer, M. Renée et al., 2016](#)) for recognition of, understanding of, and planning for the diversity that exists within the continuum of rurality.

CONCLUSION

The results of this study showed that postoperative physiotherapy rehabilitation improved knee pain, knee flexion active range of motion (AROM), and functional mobility in patients following Total Knee Arthroplasty (TKA). However, the post-intervention results demonstrated that participants in Group A achieved significantly better outcomes than those in Group B. Therefore, it can be concluded that the physiotherapy rehabilitation programme was more effective in improving pain, knee flexion AROM, and functional mobility among rural patients compared with urban patients following Total Knee Arthroplasty (TKA).

Ethical Clearance - Ethical clearance taken from Institution Ethics Committee (IEC) of Mahatma Gandhi Medical College & Hospital, Jaipur, No./MGMC&H/IEC/JPR/2026/5257, dated 14.03.2026 and informed consent was obtained from the participants. The procedures were carried out following the ethical principles enlisted in the Declaration of Helsinki and its later revisions or equivalent ethical guidelines.

CTRI Registration- Clinical trial registry done, Number: CTRI / 2026 / 04 / 109592

AUTHOR DECLARATIONS

CRedit Author Statement / Author contributions

All authors contributed to the study's design, data collection, analysis, and manuscript writing. All authors have reviewed and approved the final manuscript and affirm their accountability for the accuracy and integrity of the work.

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Conflict of Interest: The authors have no known specific competing financial or personal conflicts of interest that could have influenced the outcomes of the current study.

AI Statement: This work has benefited from the use of Grammarly, an AI-powered language tool that assisted with grammar checking, spelling correction, and clarity improvements. Grammarly produced no generative content; the responsibility for the ideas, interpretations, and conclusions remains solely with the authors.

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