Development and Evaluation of a Pharmaceutical Care Pathway for Managing Cancer Pain at Home with Implanted Intrathecal Drug Delivery Systems (IDDS)

Hua Ju, Lei Shi, Lei Chu, Weiwei Jiang

Submitted to: Journal of Medical Internet Research
on: August 23, 2024

Table of Contents

Development and Evaluation of a Pharmaceutical Care Pathway for Managing Cancer Pain at Home with Implanted Intrathecal Drug Delivery Systems (IDDS)

Hua Ju[1]; Lei Shi[2]; Lei Chu[2]; Weiwei Jiang[3]

[1]Department of pharmacy Chongqing 13th People's Hospital Chongqing CN
[2]Pain department Chongqing CN
[3]Department of pharmacy Chongqing CN

Corresponding Author:
Weiwei Jiang
Department of pharmacy
288 Astronomical Avenue
Chongqing
CN

Abstract

Background: Intrathecal infusion therapy, internationally recognized as the best treatment for intractable pain. However, owing to the high risk and uncertainty of intraspinal drug trials, clinical trials of intraspinal drug administration are strictly controlled, which may lead to the occurrence of "off-label" intraspinal drug use in current analgesic therapy. Ensuring the analgesic efficacy and safety of these drugs requires further exploration by pharmacists and clinicians.

Objective: Utilizing a mobile information cancer pain management platform, this study aims to establish a pharmaceutical manage pathway for patients managing cancer pain at home with an Intrathecal Drug Delivery System (IDDS) and to assess its clinical effect.

Methods: A retrospective analysis was conducted on 10 cancer patients with an IDDS implanted without pharmaceutical care (control group) and 10 patients with pharmaceutical care (intervention group). The monitoring period spanned from the first day of admission to 1 week post-discharge. A comparative analysis was performed on pain control, medication compliance, quality of life, and the incidence of adverse reactions between the two groups.

Results: The 24h minimum and 24h average pain scores were significantly lower in the intervention group 1 day after surgery ($P<0.05$), although there was no significant improvement in reducing DN4 score, improving pain relief rate, medication compliance, appetite and quality of life self-score in the intervention group. One week after discharge, the bodily pain (BP) score in the SF-36 scale of the intervention group significantly increased ($P<0.05$). One week after discharge, there was no significant difference in the incidence of adverse reactions between the two groups (?2=3.28, $P>0.05$).

Conclusions: Implementation of a pharmaceutical care pathway based on a mobile information cancer pain management platform effectively reduced postoperative pain scores in home cancer patients with IDDS implantation. It also enhances medication compliance and end-stage quality of life, demonstrating its potential for widespread application and further promotion.

(JMIR Preprints 23/08/2024:65706)
DOI: https://doi.org/10.2196/preprints.65706

Preprint Settings

1) Would you like to publish your submitted manuscript as preprint?

✓ **Please make my preprint PDF available to anyone at any time (recommended).**
Please make my preprint PDF available only to logged-in users; I understand that my title and abstract will remain visible to all users.
Only make the preprint title and abstract visible.
No, I do not wish to publish my submitted manuscript as a preprint.

2) If accepted for publication in a JMIR journal, would you like the PDF to be visible to the public?

✓ **Yes, please make my accepted manuscript PDF available to anyone at any time (Recommended).**
Yes, but please make my accepted manuscript PDF available only to logged-in users; I understand that the title and abstract will remain v
Yes, but only make the title and abstract visible (see Important note, above). I understand that if I later pay to participate in <a href="http

Original Manuscript

Development and Evaluation of a Pharmaceutical Care Pathway for Managing Cancer Pain at Home with Implanted Intrathecal Drug Delivery Systems (IDDS)

JU Hua[1,2], SHI Lei[3], CHU Lei[3]and JIANG Weiwei[1*]

[1] Department of pharmacy, The Second Affiliated Hospital of Chongqing Medical University, Chongqing, 400010, China.

[2] Department of pharmacy, Chongqing 13th People's Hospital, Chongqing, 400053, China.

[3] Pain department, The Second Affiliated Hospital of Chongqing Medical University, Chongqing, 400010, China.

*Corresponding author(s). E-mail(s): 304035@cqmu.edu.cn; Contributing authors: 280620921@qq.com; shilei8871@qq.com; chulei2380@163.com.

Abstract

Background: Intrathecal infusion therapy, internationally recognized as the best treatment for intractable pain. However, owing to the high risk and uncertainty of intraspinal drug trials, clinical trials of intraspinal drug administration are strictly controlled, which may lead to the occurrence of "off-label" intraspinal drug use in current analgesic therapy. Ensuring the analgesic efficacy and safety of these drugs requires further exploration by pharmacists and clinicians.

Objective: Utilizing a mobile information cancer pain management platform, this study aims to establish a pharmaceutical manage pathway for patients managing cancer pain at home with an Intrathecal Drug Delivery System (IDDS) and to assess its clinical effect.

Methods: A retrospective analysis was conducted on 10 cancer patients with an IDDS implanted without pharmaceutical care (control group) and 10 patients with pharmaceutical care (intervention group). The monitoring period spanned from the first day of admission to 1 week post-discharge. A comparative analysis was performed on pain control, medication compliance, quality of life, and the incidence of adverse reactions between the two groups.

Results: The 24h minimum and 24h average pain scores were significantly lower in the intervention group 1 day after surgery ($P<0.05$), although there was no significant improvement in reducing DN4 score, improving pain relief rate, medication compliance, appetite and quality of life self-score in the intervention group. One week after discharge, the bodily pain (BP) score in the SF-36 scale of the intervention group significantly increased ($P<0.05$). One week after discharge, there was no significant difference in the incidence of adverse reactions between the two groups ($\chi^2=3.28$, $P>0.05$).

Conclusions: Implementation of a pharmaceutical care pathway based on a mobile information cancer pain management platform effectively reduced postoperative pain scores in home cancer patients with IDDS implantation. It also enhances medication compliance and end-stage quality of life, demonstrating its potential for widespread application and further promotion.

Keywords: IDDS; Cancer pain; Pharmaceutical care; Effect evaluation

Introduction

Cancer has become a leading cause of death in China, and represents a major public health challenge. It represents a serious threat to population health and underscoring the urgency of effective interventions [1-3].

Pain is characterized as an unpleasant subjective sensation and emotional experience associated with actual or potential tissue damage. Since the American Pain Society designated pain as the fifth vital sign in 1985, the importance of pain management in clinical practice has been further emphasized. [4]. A meta-analysis highlights the persistently high incidence of pain in cancer patients globally: over one-third of patients undergoing curative treatment, more than half receiving anti-cancer treatment, and two-thirds with advanced cancer report experiencing pain, with a significant portion facing moderate to severe pain [5]. Approximately 30–50% of cancer patients experience

pain, with this proportion rising to 60–70% in advanced cancer cases [6, 7]. 40% of patients with cancer continue to experience inadequate pain control uncontrolled cancer pain profoundly affects patient's daily life, work ability, and mental well-being [8].

The Intrathecal Drug Delivery system (IDDS) is a new drug infusion mode, in which analgesic drugs such as morphine are injected directly into the spinal cord near the site of pain [9]. Compared to conventional medical management, intrathecal analgesia can significantly reduce systemic opioid consumption. It requires lower drug dosages, offers better efficacy and safety, and decreases medical utilization and costs, making it an innovative treatment option for patients with cancer pain [10-12]. However, there has been a lack of attention on how to properly monitor patients using an IDDS to improve its effectiveness and ensure safety during use. It is worth further exploration by clinical pharmacists and clinicians to ensure the analgesic efficacy and medication safety of patients.

Contemporary cancer pain management has evolved into a chronic disease management model [13] with home analgesia emerging as an effective strategy. The structured home care system empowers patients to receive appropriate pain treatment within their comfort at home. Coordination should be optimized among doctors, nurses, pharmacists, and patients in home-care settings. Despite an increasing focus on cancer pain treatment, there is a notable absence of researches on standardized pharmaceutical care for the management of cancer pain at home in IDDS. Therefore, this manuscript established and refined the pharmaceutical care pathway for managing cancer pain at home with an IDDS through a retrospective controlled study, aiming to promote the standardized clinical application of the IDDS in cancer pain management and improve the pain treatment status of home cancer pain patients.

Methods

Subjects

This study was performed in accordance with the Declaration of Helsinki (revised in 2013). The study protocol was approved by the Ethics Committee of the Second Affiliated Hospital of Chongqing Medical University (reference no. 30 of 2024). All patients and/or family members in the intervention group voluntarily participated in the study and signed the informed consent forms.

Cancer pain patients with an IDDS implanted in the Pain Department of the Second Affiliated Hospital of Chongqing Medical University from June 2021 to November 2022 were selected for the study.

Inclusion criteria:

Patients aged 16 to 80 years with confirmed advanced cancer pain.

Implantation of IDDS (including fully and semi-implantable devices).

Good compliance and willingness to cooperate with the researcher.

Normal comprehension ability, able to read or understand various scales.

Patients or family members skilled in using mobile phones and WeChat for communication.

No history of drug abuse.

Exclusion criteria:

History of related mental illness, abnormal consciousness, cognitive impairment, and inability to express pain normally

Unwillingness to cooperate with the study.

Suspected or true history of drug abuse.

Based on the implementation of standardized pharmaceutical care pathways, patients admitted between June 2021 and November 2021 were assigned to the control group, and patients admitted between December 2021 and November 2022 were assigned to the intervention group. A total of 10 patients were included in each group. The mean age of the control group and intervention group were 61.7±11.36 years and 62.4±12.98 years, respectively. The mean total hospitalization costs were 49,657.66±49,644.87 yuan and 41,788.13±38,238.71 yuan, respectively. There were no significant differences in age or total hospitalization costs between the two groups (P>0.05) (Table 1).

Pharmaceutical care pathway establishment for patients with home cancer pain implanted with IDDS

A multidisciplinary team (MDT) was established in collaboration with senior pharmaceutical experts, clinical pharmacists specializing in pain management, pain physicians, and nursing staff to provide pharmaceutical care for patients from admission to discharge. The specific implementation paths for pharmaceutical care are presented in Table 2.

Implementation stage of pharmaceutical care pathway for patients with cancer pain at home with IDDS

A mobile information cancer pain management service platform was introduced to the patients in the intervention group. The platform was employed to control patients' pain in a timely, safe, and effective manner, while also strengthening the interaction between medical staff and patients. The pharmaceutical care pathway was optimized as follows:

Preoperative preparation using the intelligent mobile app includes: 1) Clinical pharmacists establish basic information for patients on the mobile information terminal of the cancer pain management service platform (Figure 1); 2) Input ID card information; 3) Sign informed consent for the use of narcotic drugs (Figure 2); 4) Conducting a comprehensive pain assessment of patients,

recording the evaluation results in real time, the app facilitates medical staff to check the changes in patients' pain scores at any time (Figure 3); 5) Assessment of the patient's liver and kidney function and other laboratory test results (Figure 4); 6) Discuss with the physician about the proposed intrathecal analgesic drug treatment plan; 7) Selection of drugs and determining the dosage.

The analgesic pump was connected to the gateway of the cancer pain management platform, allowing data to be transmitted back to the mobile information terminal in real time (Figure 5). Physicians/pharmacists can monitor the operation of an analgesia pump and patient-controlled analgesia in real time through a mobile information terminal and intervene promptly when problems are detected.

Effect evaluation phase

Differences in the following indicators at the corresponding time points between the two groups were compared.

Observing Indicators

(1) Brief Pain Inventory (BPI) Score: Patients selected a point value from 0 to 10, with 0 representing no pain and 10 representing the most intense pain. Higher scores indicate more severe pain. The pain relief rates ranged from 0% (no relief) to 100% (complete relief), with higher percentages indicating better pain control. Pain assessments were conducted one day after surgery and one week after discharge, and the BPI scores were recorded.

(2) Douleur Neuropathique 4 Questions (DN4) score: Patients with cancer often experience Neuropathic Pain (NP). The DN4 scale is a routine screening tool for NP, with a maximum score of 10. A score of 4 or higher strongly suggests NP, whereas a score below 4 makes it unlikely. NP screening was performed one week after discharge, and DN4 scores were calculated.

(3) Medication compliance: Medication compliance was assessed using the Morisky Medication Adherence Scale (MMAS-8). Pharmacists analyzed the scores, categorizing them as poor compliance (score <6), medium compliance (score 6-7), and good compliance (score 8). The assessment was conducted one week after discharge, and the MMAS-8 results were recorded.

(4) Quality of life (QOL) score: The QOL survey was conducted one day after the operation, with the results from QOL-BREF recorded. One week after discharge, patient scores on the MOS 36-Item Short-Form Health Survey (SF-36) were calculated. In both surveys, Higher scores indicate a better health status.

(5) Incidence of adverse reactions to analgesics: The occurrence of adverse reactions related to analgesics, such as constipation, nausea and vomiting, urinary retention, pruritus, dizziness, headache, and respiratory depression, was recorded from the first day of admission to the first week

after discharge. The overall incidence of adverse reactions was calculated.

Statistical analysis

Statistical analyses were performed using SPSS version 27.0. The count data were analyzed directly. T-tests were used to compare intergroup BPI, DN4, QOL-BREF, and SF-36 scores, with measurement data expressed as mean ± standard deviation ($\bar{x} \pm s$). The Chi-square test was used to compare the quality of appetite and incidence of adverse reactions to analgesics between groups. Statistical significance was set at $P < 0.05$.

Results

Comparison of pain control before and after implementation of pharmaceutical care pathway

Brief Pain Inventory (BPI) Score

One day after surgery, the average 24 h maximum pain scores of the control and intervention group were 4.90±2.42 and 2.80±1.40, respectively (P>0.05). The mean values of the 24 h minimum pain scores were 2.90±1.53 and 1.20±0.79, respectively (P<0.05). 24 h average pain scores were 3.90±1.88 and 2.00±0.91, respectively (P<0.05). The mean present pain scores were 2.90±1.52 and 1.70±1.57, respectively (P>0.05). The mean 24 h pain relief rates (%) were 47.00±19.47 and 66.00±22.71, respectively (P>0.05).

As indicated above, there was no significant difference in the 24 h maximum pain score, present pain score and 24 h pain relief rate (%) between the two groups. However, the 24 h minimum pain score and 24 h average pain score in the intervention group one day after surgery were significantly lower than those in the control group, with a statistically significant difference, as shown in Table 3.

Douleur Neuropathique 4 Questions Naire (DN4) Score

One week after discharge, the mean DN4 scores were 0.80±0.79 for the control group and 0.60±0.97 for the intervention group, respectively (P>0.05). However, the mean DN4 score of patients in the intervention group at one week after discharge was lower than that of the control group, suggesting a downward trend in DN4 scores after pharmaceutical care intervention, as shown in Table 4.

Comparison of medication compliance before and after implementation of pharmaceutical care pathway

Four and seven patients in the control and intervention groups, respectively, had good/moderate

compliance one week after discharge. Six and three patients had poor compliance, with compliance rates of 40% and 70%, respectively. Compared to the control group, the medication compliance of patients in the intervention group improved by 30%, as shown in Table 5.

Comparison of quality of life before and after the implementation of pharmaceutical care pathway

QOL-BREF Score

Given that most patients remain in bed one day after surgery, investigating differences in physical health, psychological status, social relations, and the surrounding environment between the two groups at this time holds little significance. However, similar to pain, appetite loss is a common primary complaint among cancer patients and significantly impacts their quality of life. Therefore, only two items in the QOL-BREF score--appetite and total patient score--were compared one day after surgery.

One day after surgery, there were 6 cases of very poor appetite in the control while 2 cases in the intervention groups; There were 3 and 5 cases of poor appetite, 0 and 1 case of moderate appetite, and 1 and 2 cases of good appetite, respectively. Although the appetite and the self-score of patients' quality of life in the intervention group showed a trend of improvement one day after surgery, these differences were not statistically significant (P>0.05), as shown in Table 6.

SF-36 Score

One week after discharge, the Physical Functioning (PF) of control group and intervention group was 32.50±29.65 and 57.50±29.18, respectively, P>0.05; Role Physical (RP) was 5.00±10.54 and 10.00±12.91, respectively, P>0.05; Bodily Pain (BP) was 37.75±12.43 and 57.75±10.62, respectively, P<0.05; General Health (GH) was 29.50±8.32 and 32.00±6.75, respectively, P>0.05. Vitality (VT) was 52.50±12.53 and 61.00±9.07, respectively (P>0.05). Social Functioning (SF) scores were 36.25±19.94 and 43.75±18.87, respectively (P>0.05). Role Emotional (RE) was 26.66±40.98 and 50.00±47.79, respectively, P>0.05; Mental Health (MH) was 56.40±19.82 and 69.60±11.35, respectively, P>0.05.

The BP score in the intervention group was higher than that in the control group, and the higher the score, the less the influence of pain on life. Therefore, the degree of pain in the intervention group was less than that in the control group, and the difference was statistically significant. Moreover, the intervention group exhibited improvements in the mean scores of PF, RP, GH, VT, SF, RE, and MH, reflecting an increasing trend in patients' quality of life. However, these differences were not significant (Table 7).

Comparison of the incidence of adverse reactions before and after implementation of pharmaceutical care pathway

The number and percentage of constipation in the control group and the intervention group were 6 (60%) and 2 (20%). For nausea and vomiting , the numbers were 7 (70%) and 4 (40%) ; for urinary retention,1 (10%) in both groups; for dizziness, 1 (10%) and 2 (20%); and for headache, 0 (0%) and 1 (10%), respectively. There were no statistically significant differences (χ^2=3.28, P>0.05), as shown in Table 8.

Discussion

Pain is the most common complaint among patients with cancer [14] and it is often the most distressing and unbearable aspect of their suffering [15, 16]. Prolonged, unrelieved pain can lead to pathological remodeling of the central nervous system, making pain increasingly difficult to control. The inadequate and ineffective management of cancer pain can significantly compromise patients' quality of life and even impact their overall survival [17, 18]. Managing patients with implanted IDDS presents a higher level of complexity and risk compared to the average pain patient. To address this challenge, standardized pharmaceutical care pathways need to be established. For example, a recent study explored the implementation of a clinical care pathway that resulted in benefits for cancer patients with reduced pain intensity and hospital stay[19]. However, while clinical care pathways are advantageous for patients, nurses may lack sufficient knowledge regarding drug therapy and the prevention and treatment of adverse reactions. On the other hand, clinical pharmacists possess a higher level of expertise in managing drug treatments. This suggests that implementing a pharmaceutical care pathway may be more beneficial, which is why we conducted this study.

Our goal was to establish a cancer pain management model that combines the expertise of physicians and pharmacists. Various studies have demonstrated that the use of electronic health services can enhance the management of chronic pain in adults[20, 21]. A recent study showed that the application of digital health technology has been successful in reducing pain scores and improving the quality of life in patients with breast cancer [22]. These findings suggest that digital health systems may be effective devices for continuously monitoring the physical and mental status of cancer patients. Therefore, we introduced a mobile information cancer pain management service platform, building upon the foundation of traditional pharmaceutical care.

This study comprehensively evaluated 20 home cancer pain patients with IDDS, focusing on pain

control, medication compliance, quality of life, and incidence of adverse reactions to analgesics. Compared with the control group, the minimum pain score at 24 h and the average pain score at 24 h in the intervention group were significantly decreased at day 1 post-operation, which represent the positive impact of incorporating clinical pharmacists into the treatment teams. Pharmacists conducted comprehensive pain assessments using the mobile information cancer pain management platform, actively participated in clinical rounds, and collaboratively developed intrathecal analgesia programs with physicians. Real-time monitoring of the analgesia pump and patient-controlled analgesia via a mobile app optimized the traditional pharmaceutical care approach, resulting in more timely and effective postoperative pain control. The current pain scores of the intervention group one day after surgery and 1 week after discharge were lower than those of the control group, the 24h pain relief rate exhibited an increasing trend, but lacked statistical significant differences in the results.

Pain can be categorized into nociceptive pain and neuropathologic pain according to its pathophysiology. Cancer pain typically involves a mix of both types, and the foundation of its management relies in non-opioid, opioid, and adjuvant drug treatment [23]. The complex of cancer pain presents significant challenges for its effective treatment [24, 25]. Reducing neuropathic pain in patients is also a key aspect for clinical pharmacists to implement pharmaceutical care as effectively as possible. In this study, the DN4 scores of patients in the intervention group were generally lower than those in the control group one week after discharge, suggesting better control of neuropathic pain following comprehensive pharmaceutical care intervention. The lack of statistically significant differences in the DN4 scores between the two groups may be attributed to the small sample size.

Chinese cancer patients experiencing pain often exhibit reluctance to use opioids due to concerns about potential addiction [26] and traditional beliefs related to "pain tolerance" [27, 28], leading to suboptimal drug compliance, thereby impacting clinical efficacy. Previous studies have shown that educating patients about cancer pain can improve their cognition, help them improve medication compliance, and thus, better control pain [29, 30], as also shown in our study.

Patients experiencing cancer pain often face additional symptoms such as fatigue, lethargy, and loss of appetite, which are most common non-pain symptoms in patients with terminal cancer [31]. These symptoms can greatly impact the quality of life of cancer patients[32]. In the current study, self-reported appetite and quality of life scores in the intervention group were higher than those in the control group one day after surgery. This indicates that monitoring through pharmacists may have a positive impact on improving patients' quality of life.

Quality of life assessment has been widely employed in cancer research in the medical field [33-35]. Previous studies have shown a significant negative correlation between pain and all areas of

quality of life, and severe pain significantly affects patients' quality of life[36, 37]. While the PF, RP, GH, VT, SF, RE, and MH scores in the intervention group did not show significant improvement, this may be due to the excessive physical exertion experienced by end-stage cancer patients as a result of tumor invasion, distant metastasis, radiotherapy, chemotherapy, and surgery, resulting in poor physical condition. Although pain relief was achieved, but other bodily functions did not show significant restoration. Due to the small sample size, we were unable to further exclude these factors for analysis. This also indicates that when clinical pharmacists are monitoring patients, they should pay greater attention to the patient's psychological changes, provide palliative care, and focus on improving RE and MH scores.

In addition to pain control, addressing and preventing adverse reactions to analgesics are crucial aspects of cancer pain management. The primary complications associated with intrathecal analgesia are adverse reactions to opioids [38, 39]. Research has consistently identified constipation, nausea and vomiting as the most common adverse reactions to opioids in patients with chronic cancer pain [40, 41]. Notably, the dose required to produce these side effects is often lower than the dose needed for effective pain relief. Constipation, in particular, is a challenging adverse reaction during opioid therapy [42], as its alleviation is often slow, once it occurs [43]. This can hinder analgesic treatment and reduce quality of life. A study by Ishihara et al. showed that preventive interventions provided by pharmacists can significantly reduce opioid-induced constipation and vomiting [44]. Numerous studies have underscored the crucial role of pharmacists in providing comprehensive education to patients regarding early prevention and treatment [45, 46]. In our study, the incidence of constipation, nausea, and vomiting and the total number of adverse reactions in the intervention group were lower than those in the control group after one week of discharge. This suggests that pharmaceutical care interventions may have a positive effect in reducing the incidence of adverse reactions to analgesics.

Study limitations and suggestions for future research

Due to the high cost of a fully implantable IDDS, fewer patients can afford it in some countries. However, semi-implantable IDDS also has problems, such as high risk of infection and difficult post-implantation management. Currently, this technology is only available in a limited number of top-tier teaching hospitals in the country and has not been widely adopted nationwide. The scope of this study was confined to a single hospital, and due to the limitations of manpower and research time, only a small number of cases were included. It is expected that more case will be collected in the future.

Conclusion

Through the implementation of a pharmaceutical care pathway based on the mobile information cancer pain management platform, a notable reduction in the postoperative pain score was achieved for cancer pain patients at home with implanted IDDS. Additionally, improvements in medication compliance, somatic pain scores in the SF-36 assessment, and overall quality of life of the patients were observed. To sum up, the establishment of a multidisciplinary diagnosis and treatment platform that integrates pharmaceutical care, clinical diagnosis and treatment, and extended care, with a focus on patients experiencing cancer pain at home with IDDS implants, and the utilization of remote information management for evaluation and monitoring represent an innovative management and service model. This model ensures safe, sustained, and effective analgesia in patients with advanced cancer pain. This approach is deemed worthy of clinical promotion and widespread application.

Acknowledgments

We thank all of our patients for donating precious time and samples. We thank Rehn Medtech for technical support of the information cancer pain management platform.

Data availability

The data generated in this study are available upon reasonable request from the corresponding author.

Conflict of interest

The authors declare no potential conflicts of interest.

Authors’ Disclosures

JIANG Weiwei reports that this work was supported by the Senior Medical Talents Program of Chongqing for Young and Middle-aged people and Kuanren Talents Program of The Second Affiliated Hospital of Chongqing Medical University. No disclosures were reported by the other authors.

Authors' Contributions

JU Hua: Data curation, formal analysis, investigation, methodology, writing–original draft, writing–review, and editing. SHI Lei: Methodology, writing–original draft, writing–review, and editing. CHU Lei: Methodology, writing–review, and editing. JIANG Weiwei: Methodology, writing–original draft, writing–review, and editing.

Note

No supplementary data for this article.

References

1. Huang H, Sun PY, Zou KY, He J, Zhang YW. [Current situation and prospect of primary prevention of cancer in China]. Zhonghua zhong liu za zhi [Chinese journal of oncology]. 2022 Sep 23;44(9):942-9. PMID: 36164695. doi: 10.3760/cma.j.cn112152-20220209-00083.
2. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. CA: a cancer journal for clinicians. 2021 May;71(3):209-49. PMID: 33538338. doi: 10.3322/caac.21660.
3. Feng RM, Zong YN, Cao SM, Xu RH. Current cancer situation in China: good or bad news from the 2018 Global Cancer Statistics? Cancer communications (London, England). 2019 Apr 29;39(1):22. PMID: 31030667. doi: 10.1186/s40880-019-0368-6.
4. Kutlutürkan S, Urvaylıoğlu AE. Evaluation of Pain as A Fifth Vital Sign: Nurses' Opinions and Beliefs. Asia-Pacific journal of oncology nursing. 2020 Jan-Mar;7(1):88-94. PMID: 31879689. doi: 10.4103/apjon.apjon_39_19.
5. van den Beuken-van Everdingen MH, Hochstenbach LM, Joosten EA, Tjan-Heijnen VC, Janssen DJ. Update on Prevalence of Pain in Patients With Cancer: Systematic Review and Meta-Analysis. Journal of pain and symptom management. 2016 Jun;51(6):1070-90.e9. PMID: 27112310. doi: 10.1016/j.jpainsymman.2015.12.340.
6. Ganguly A, Michael M, Goschin S, Harris K, McFarland DC. Cancer Pain and Opioid Use Disorder. Oncology (Williston Park, NY). 2022 Sep 7;36(9):535-41. PMID: 36107782. doi: 10.46883/2022.25920973.
7. Dupoiron D, Duarte R, Carvajal G, Aubrun F, Eldabe S. Rationale and Recent Advances in Targeted Drug Delivery for Cancer Pain: Is It Time to Change the Paradigm? Pain physician. 2022 May;25(3):E414-e25. PMID: 35652767.
8. Pain management for patients with cancer. CA: a cancer journal for clinicians. 2018 May;68(3):197-8. PMID: 29603144. doi: 10.3322/caac.21454.
9. Smyth C, Ahmadzai N, Wentzell J, Pardoe A, Tse A, Nguyen T, et al. Intrathecal Analgesia for Chronic Refractory Pain: Current and Future Prospects. Drugs. 2015 Nov;75(17):1957-80. PMID: 26501979. doi: 10.1007/s40265-015-0471-1.

10. Perruchoud C, Dupoiron D, Papi B, Calabrese A, Brogan SE. Management of Cancer-Related Pain With Intrathecal Drug Delivery: A Systematic Review and Meta-Analysis of Clinical Studies. Neuromodulation : journal of the International Neuromodulation Society. 2023 Aug;26(6):1142-52. PMID: 35088743. doi: 10.1016/j.neurom.2021.12.004.
11. Stearns LJ, Hinnenthal JA, Hammond K, Berryman E, Janjan NA. Health Services Utilization and Payments in Patients With Cancer Pain: A Comparison of Intrathecal Drug Delivery vs. Conventional Medical Management. Neuromodulation : journal of the International Neuromodulation Society. 2016 Feb;19(2):196-205. PMID: 26816205. doi: 10.1111/ner.12384.
12. Magee DJ, Schutzer-Weissmann J, Pereira EAC, Brown MRD. Neuromodulation techniques for cancer pain management. Current opinion in supportive and palliative care. 2021 Jun 1;15(2):77-83. PMID: 33843762. doi: 10.1097/spc.0000000000000549.
13. Treede RD, Rief W, Barke A, Aziz Q, Bennett MI, Benoliel R, et al. Chronic pain as a symptom or a disease: the IASP Classification of Chronic Pain for the International Classification of Diseases (ICD-11). Pain. 2019 Jan;160(1):19-27. PMID: 30586067. doi: 10.1097/j.pain.0000000000001384.
14. Lee SH, Kim JY, Yeo S, Kim SH, Lim S. Meta-Analysis of Massage Therapy on Cancer Pain. Integrative cancer therapies. 2015 Jul;14(4):297-304. PMID: 25784669. doi: 10.1177/1534735415572885.
15. Paisley P, Serpell M. The role of topiceuticals in cancer pain. Current opinion in supportive and palliative care. 2017 Jun;11(2):93-8. PMID: 28460372. doi: 10.1097/spc.0000000000000271.
16. Wang Y, Qin D, Guo Z, Shi F, Cannella N, Ciccocioppo R, et al. Research progress on the potential novel analgesic BU08028. European journal of pharmacology. 2022 Jan 5;914:174678. PMID: 34875275. doi: 10.1016/j.ejphar.2021.174678.
17. Caraceni A, Hanks G, Kaasa S, etc. Use of opioid analgesics in the treatment of cancer pain: evidence-based recommendations from the EAPC. The Lancet Oncology. 2012 Feb;13(2):e58-68. PMID: 22300860. doi: 10.1016/s1470-2045(12)70040-2.
18. Haun MW, Estel S, Rücker G, Friederich HC, Villalobos M, Thomas M, et al. Early palliative care for adults with advanced cancer. The Cochrane database of systematic reviews. 2017 Jun 12;6(6):Cd011129. PMID: 28603881. doi: 10.1002/14651858.CD011129.pub2.
19. Løhre ET, Thronæs M, Brunelli C, Kaasa S, Klepstad P. An in-hospital clinical care pathway with integrated decision support for cancer pain management reduced pain intensity and needs for hospital stay. Supportive care in cancer : official journal of the Multinational Association of Supportive Care in Cancer. 2020 Feb;28(2):671-82. PMID: 31123870. doi: 10.1007/s00520-019-04836-8.
20. Burke D, Lennon O, Blake C, Nolan M, Barry S, Smith E, et al. An internet-delivered cognitive behavioural therapy pain management programme for spinal cord injury pain: A randomized controlled trial. European journal of pain (London, England). 2019 Aug;23(7):1264-82. PMID: 31002442. doi: 10.1002/ejp.1402.
21. Du S, Liu W, Cai S, Hu Y, Dong J. The efficacy of e-health in the self-management of chronic low back pain: A meta analysis. International journal of nursing studies. 2020 Jun;106:103507. PMID: 32320936. doi: 10.1016/j.ijnurstu.2019.103507.
22. Masiero M, Filipponi C, Fragale E, Pizzoli SFM, Munzone E, Milani A, et al. Support for Chronic Pain Management for Breast Cancer Survivors Through Novel Digital Health Ecosystems: Pilot Usability Study of the PainRELife Mobile App. JMIR formative research. 2024 Feb 2;8:e51021. PMID: 38306176. doi: 10.2196/51021.
23. Brozović G, Lesar N, Janev D, Bošnjak T, Muhaxhiri B. CANCER PAIN AND THERAPY. Acta clinica Croatica. 2022 Sep;61(Suppl 2):103-8. PMID: 36824638. doi: 10.20471/acc.2022.61.s2.13.
24. Chen J, Kandle PF, Murray IV, Fitzgerald LA, Sehdev JS. Physiology, Pain. StatPearls. Treasure Island (FL) with ineligible companies. Disclosure: Patricia Kandle declares no relevant

financial relationships with ineligible companies. Disclosure: Ian Murray declares no relevant financial relationships with ineligible companies. Disclosure: Lauren Fitzgerald declares no relevant financial relationships with ineligible companies. Disclosure: Jasjit Sehdev declares no relevant financial relationships with ineligible companies.: StatPearls Publishing

25. Ji J, Guo J, Chi Y, Su F. Cancer Pain Management with Traditional Chinese Medicine: Current Status and Future Perspectives. The American journal of Chinese medicine. 2024;52(1):123-35. PMID: 38281918. doi: 10.1142/s0192415x24500058.
26. Xia Z. Cancer pain management in China: current status and practice implications based on the ACHEON survey. Journal of pain research. 2017;10:1943-52. PMID: 28860849. doi: 10.2147/jpr.S128533.
27. Chen LM, Miaskowski C, Dodd M, Pantilat S. Concepts within the Chinese culture that influence the cancer pain experience. Cancer nursing. 2008 Mar-Apr;31(2):103-8. PMID: 18490884. doi: 10.1097/01.NCC.0000305702.07035.4d.
28. Ho AH, Chan CL, Leung PP, Chochinov HM, Neimeyer RA, Pang SM, et al. Living and dying with dignity in Chinese society: perspectives of older palliative care patients in Hong Kong. Age and ageing. 2013 Jul;42(4):455-61. PMID: 23443510. doi: 10.1093/ageing/aft003.
29. Kimura M. [Consideration of Advanced Pharmaceutical Control Functions through Pharmacy-provided Home Pharmaceutical Care]. Yakugaku zasshi : Journal of the Pharmaceutical Society of Japan. 2020;140(7):841-50. PMID: 32612045. doi: 10.1248/yakushi.19-00237-1.
30. Lapão LV, da Silva MM, Gregório J. Implementing an online pharmaceutical service using design science research. BMC medical informatics and decision making. 2017 Mar 27;17(1):31. PMID: 28347304. doi: 10.1186/s12911-017-0428-2.
31. Batra A, Yang L, Boyne DJ, Harper A, Cuthbert CA, Cheung WY. Symptom burden in patients with common cancers near end-of-life and its associations with clinical characteristics: a real-world study. Supportive care in cancer : official journal of the Multinational Association of Supportive Care in Cancer. 2021 Jun;29(6):3299-309. PMID: 33104922. doi: 10.1007/s00520-020-05827-w.
32. van den Beuken-van Everdingen MH, de Rijke JM, Kessels AG, Schouten HC, van Kleef M, Patijn J. Quality of life and non-pain symptoms in patients with cancer. Journal of pain and symptom management. 2009 Aug;38(2):216-33. PMID: 19564094. doi: 10.1016/j.jpainsymman.2008.08.014.
33. Ohashi K, Suzuki H, Sata Y, Tanaka K, Yamamoto T, Sakairi Y, et al. Postoperative pain and quality of life after lung cancer surgery: a prospective observational study. Annals of palliative medicine. 2023 Mar;12(2):346-55. PMID: 36627847. doi: 10.21037/apm-22-207.
34. Aboelnour NH, Kamel FH, Basha MA, Azab AR, Hewidy IM, Ezzat M, et al. Combined effect of graded Thera-Band and scapular stabilization exercises on shoulder adhesive capsulitis post-mastectomy. Supportive care in cancer : official journal of the Multinational Association of Supportive Care in Cancer. 2023 Mar 16;31(4):215. PMID: 36922413. doi: 10.1007/s00520-023-07641-6.
35. Salha LA, de Menezes JE, Dias DR, Brasil VV, Ferreira PL, de Santana Filho JM, et al. Judicialization and cancer: quality of life of patients and caregivers in the COVID-19 pandemic. Health and quality of life outcomes. 2023 Aug 11;21(1):87. PMID: 37568236. doi: 10.1186/s12955-023-02173-3.
36. Green A, Jerzmanowska N, Thristiawati S, Green M, Lobb EA. Culturally and linguistically diverse palliative care patients' journeys at the end-of-life. Palliative & supportive care. 2019 Apr;17(2):227-33. PMID: 29860963. doi: 10.1017/s1478951518000147.
37. Yin M, Gu K, Cai H, Shu XO. Association between chronic pain and quality of life in long-term breast cancer survivors: a prospective analysis. Breast cancer (Tokyo, Japan). 2023 Sep;30(5):785-95. PMID: 37329439. doi: 10.1007/s12282-023-01472-3.
38. Xu Z, Tang Z, Yao J, Liang D, Jin F, Liu Y, et al. Comparison of low-dose morphine

intrathecal analgesia and sufentanil PCIA in elderly patients with hip fracture undergoing single spinal anesthesia - a randomized clinical trial. BMC anesthesiology. 2022 Apr 27;22(1):124. PMID: 35477377. doi: 10.1186/s12871-022-01677-7.
39. Ratnasekara V, Weinberg L, Johnston SA, Fletcher L, Nugraha P, Cox DRA, et al. Multimodal intrathecal analgesia (MITA) with morphine for reducing postoperative opioid use and acute pain following hepato-pancreato-biliary surgery: A multicenter retrospective study. PloS one. 2023;18(9):e0291108. PMID: 37682837. doi: 10.1371/journal.pone.0291108.
40. Corli O, Floriani I, Roberto A, Montanari M, Galli F, Greco MT, et al. Are strong opioids equally effective and safe in the treatment of chronic cancer pain? A multicenter randomized phase IV 'real life' trial on the variability of response to opioids. Annals of oncology : official journal of the European Society for Medical Oncology. 2016 Jun;27(6):1107-15. PMID: 26940689. doi: 10.1093/annonc/mdw097.
41. Kong L, Wang J, Guan S, Chen X, Li M, Gao L, et al. Nomogram for predicting opioid-induced nausea and vomiting for cancer pain patients. Supportive care in cancer : official journal of the Multinational Association of Supportive Care in Cancer. 2023 Nov 2;31(12):663. PMID: 37914831. doi: 10.1007/s00520-023-08144-0.
42. Cobo Dols M, Beato Zambrano C, Cabezón-Gutiérrez L, Chicas-Sett R, Blancas López-Barajas MI, García Navalón FJ, et al. One-year efficacy and safety of naloxegol on symptoms and quality of life related to opioid-induced constipation in patients with cancer: KYONAL study. BMJ supportive & palliative care. 2023 Dec 7;13(e2):e318-e26. PMID: 33707299. doi: 10.1136/bmjspcare-2020-002816.
43. Sizar O, Genova R, Gupta M. Opioid-Induced Constipation. StatPearls. Treasure Island (FL): StatPearls Publishing; 2024.
44. Ishihara M, Iihara H, Okayasu S, Yasuda K, Matsuura K, Suzui M, et al. Pharmaceutical interventions facilitate premedication and prevent opioid-induced constipation and emesis in cancer patients. Supportive care in cancer : official journal of the Multinational Association of Supportive Care in Cancer. 2010 Dec;18(12):1531-8. PMID: 19921282. doi: 10.1007/s00520-009-0775-3.
45. Dzierżanowski T, Mercadante S. Constipation in Cancer Patients - an Update of Clinical Evidence. Current treatment options in oncology. 2022 Jul;23(7):936-50. PMID: 35441979. doi: 10.1007/s11864-022-00976-y.
46. Farmer AD, Holt CB, Downes TJ, Ruggeri E, Del Vecchio S, De Giorgio R. Pathophysiology, diagnosis, and management of opioid-induced constipation. The lancet Gastroenterology & hepatology. 2018 Mar;3(3):203-12. PMID: 29870734. doi: 10.1016/s2468-1253(18)30008-6.

Tables

Table 1. Comparison of basic demographic data of research objects

Project	control group	Intervention group	P value

N	10	10	
Gender (Male)	5	5	
Ethnic group (Han)	10	10	
Age (years)	61.7±11.36	62.4±12.98	0.92
Marital status (Married)	10	9	
Medical insurance category			
Medical insurance for urban and rural residents	5	5	
Medical insurance for urban workers	5	5	
Total hospital expenses (Yuan)	49657.66±49644.87	41788.13±38238.71	0.70
Educational level			
Primary/Junior High School	6	7	
High school/technical secondary school	2	2	
College/Undergraduate	2	1	
Occupation			
freelancer	6	1	
Retired personnel	2	2	
Peasant	1	1	
Civil servant	1	0	
Worker	0	3	
Service industry	0	2	
Pupil	0	1	
Types of cancer			
Lung cancer	1	4	
Breast cancer	1	0	
Liver cancer	1	0	
Thoracic vertebral carcinoma	1	0	
Cervical carcinoma	1	0	
Pancreatic cancer	2	2	
Rectal cancer	1	0	
Brain cancer	1	0	
Sigmoid colon cancer	1	0	
Bladder cancer	0	1	
Anaplastic large cell tumor	0	1	
Gastric cancer	0	1	
Thyroid cancer	0	1	

Table 2. Implementation path of pharmaceutical care for cancer pain patients with IDDS implantation at home

Time	pharmacist work content[1]	Implementation way	implementation method	Monitoring project
Day 1 of admission	Comprehensive pain assessment	Bedside consultation	The pharmacist assists the physician in formulating the initial treatment plan.	Daily monitoring of pain (location, nature, intensity, pain or not), temperature, blood pressure changes; Pay daily attention to the change of inspection indicators; Patients were observed daily for ADR after medication. The incision was observed for bleeding, fluid seepage, redness and swelling after operation.
1 day before surgery	Preoperative preparation	Bedside consultation	Physicians and pharmacists jointly develop intrathecal analgesia program.	
1 day after surgery	Pain assessment (BPI); Conduct QOL-BREF investigation; The clinical manifestations and management measures of insufficient/excessive analgesia; Eating healthy guidance.	Inform patients of the timing and precautions for pressing Patient Controlled Analgesia (PCA) button during pharmacy rounds; WeChat push.	Pain assessment results were recorded; Health education.	
2 days after surgery	Monitoring the operation of analgesic pump; The number of compressions, ADRs of intrathecal analgesics and treatment measures in the first 24 h were recorded.	Pharmaceutical rounds, teaching patients/family members to record pain logs; WeChat push.	Record pain assessment results; Health education.	
3 days after surgery	PCA analgesic efficacy evaluation, timely adjustment of analgesic program.	Pharmaceutical rounds	Record the results of pain assessment and communicate with the physician after the pharmacist inquiries about the patient's pain control.	
Discharge date[3]	Discharge medication education, diet health guidance.	Bedside guide	Health education	
Discharged for 1 day	Interaction with patients at a fixed time, to answer questions encountered by patients, to understand whether patients have anxiety and depression, targeted comfort and	Follow-up of patients by phone/WeChat	Answer questions online	

	counseling.		
Discharged 1 week[4]	Fixed time[2] to remind patients to expect the next time to replace the analgesic pump cartridge; Interact with patients to answer questions; Pain assessment (BPI, DN4); Medication compliance and SF-36 were investigated.	Follow-up of patients by phone/WeChat	Answer questions online

[1]In addition to the time points mentioned in the table above, clinical pharmacists of pain specialty routinely provide pharmaceutical care for patients from the first day of admission to the first week of discharge.

[2] Fixed time: 09:00-12:00; 14:00-18:00, interaction time ≥15min.

[3] On the day of discharge, the patient will be issued with a notice on the use of an intravaginal pump outside the hospital; it is forbidden to adjust the dosage by oneself, draw the liquid medicine for use, and change the medicine regularly.

[4] One week after discharge, clinical pharmacists in the pain department will push the contents of the SF-36 survey summary form to the patients/family members on WeChat in advance, make a phone appointment for the survey, explain the usage of the scale to the patients/family members through a WeChat video call, and carry out the survey. Clinical pharmacists will fill in the scale according to the answers of the patients/family members on the spot and collect the occurrence of adverse reactions in patients receiving analgesic drugs.

Table 3. Comparison of BPI scores 1 day after surgery and 1 week after discharge between the two groups (n=20)

	Control group		Intervention group		P value	
Project	1 day after surgery	Discharged 1 week	1 day after surgery	Discharged 1 week	1 day after surgery	Discharge d 1 week
24 h most intense pain score	4.90±2.42	3.30±1.16	2.80±1.40	3.60±1.71	0.29	0.65
24 h minimum pain score	2.90±1.53	2.20±1.14	1.20±0.79	1.70±1.34	0.01	0.38
24 h average pain score	3.90±1.88	2.70±1.21	2.00+0.91	2.65±1.33	0.01	0.93
Present pain score	2.90±1.52	2.30±1.25	1.70±1.57	1.80±1.32	0.10	0.40
24 h pain relief rate (%)	47.00±19.47	40.00±23.09	66.00±22.71	55.00±26.77	0.06	0.20

Table 4. Comparison of DN4 scores 1 week after discharge between the two groups (n=20)

Project	Control group	Intervention group	P value
DN4 score	0.80±0.79	0.60±0.97	0.62

Table 5. Comparison of medication compliance 1 week after discharge between the two groups (n=20)

Group	Good/medium compliance	Poor compliance	Total	Compliance rate (%)
Control group	4	6	10	40
Intervention group	7	3	10	70
Total	11	9	20	55

Table 6. Comparison of QOL-BREF self- assessment results 1 day after surgery between the two groups (n=20)

Project	Group	Number and percentage of cases		χ^2	P value
		Control group	Intervention group		
Appetite	Very bad	6（60）	2（20）		
	Poor	3（30）	5（50）		
	Neither good nor bad	0（0）	1（10）		
	Good	1（10）	2（20）		
	Total	10	10	3.83	0.28
Patient Quality of Life self-score (100 points)		56.70±13.52	70.90±14.77		0.38

Table 7. Comparison of SF-36 quality of life scores 1 week after discharge between the two groups (n=20)

Project	Control group	Intervention group	P value
PF	32.50±29.65	57.50±29.18	0.074
RP	5.00±10.54	10.00±12.91	0.355
BP	37.75±12.43	57.75±10.62	0.001
GH	29.50±8.32	32.00±6.75	0.470
VT	52.50±12.53	61.00±9.07	0.099
SF	36.25±19.94	43.75±18.87	0.399
RE	26.66±40.98	50.00±47.79	0.256
MH	56.40±19.82	69.60±11.35	0.084

Table 8. Comparison of the incidence of analgesic adverse reactions 1 week after discharge between the two groups (n=20)

Project	Number and percentage of adverse drug reactions		$\chi 2$	P value
	Control group	Intervention group		
Constipation	6（60）	2（20）		
Nausea and vomiting	7（70）	4（40）		
Urinary retention	1（10）	1（10）		
Giddy	1（10）	2（20）		
Headache	0（0）	1（10）		
Total	15	10	3.28	0.51

Figures

Figure 1. Basic patient information entry

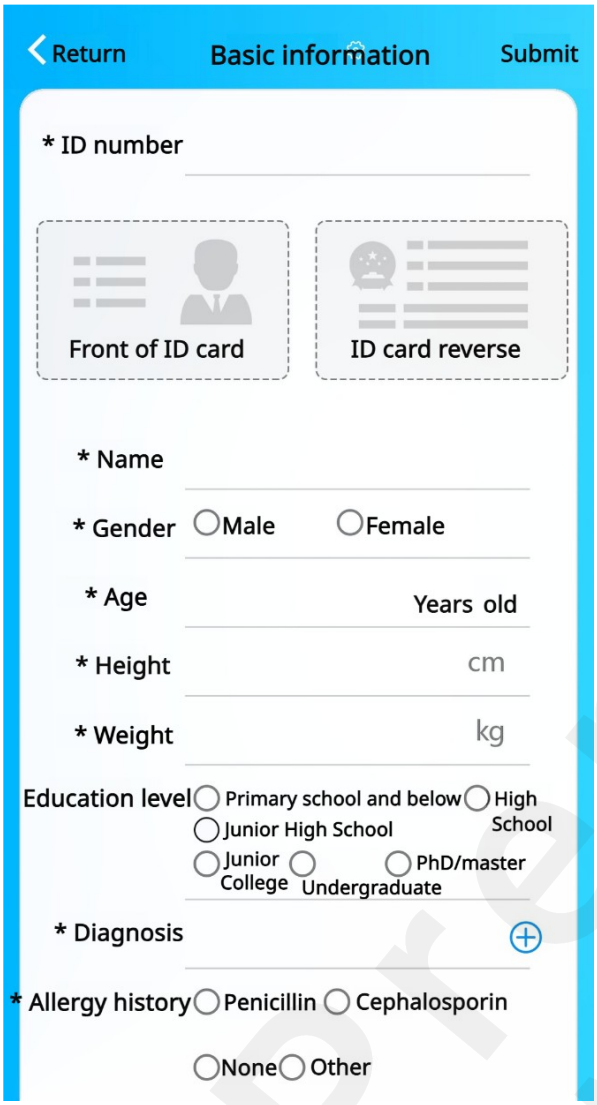


Figure 2. Informed consent for the use of narcotic drugs and psychotropic substances

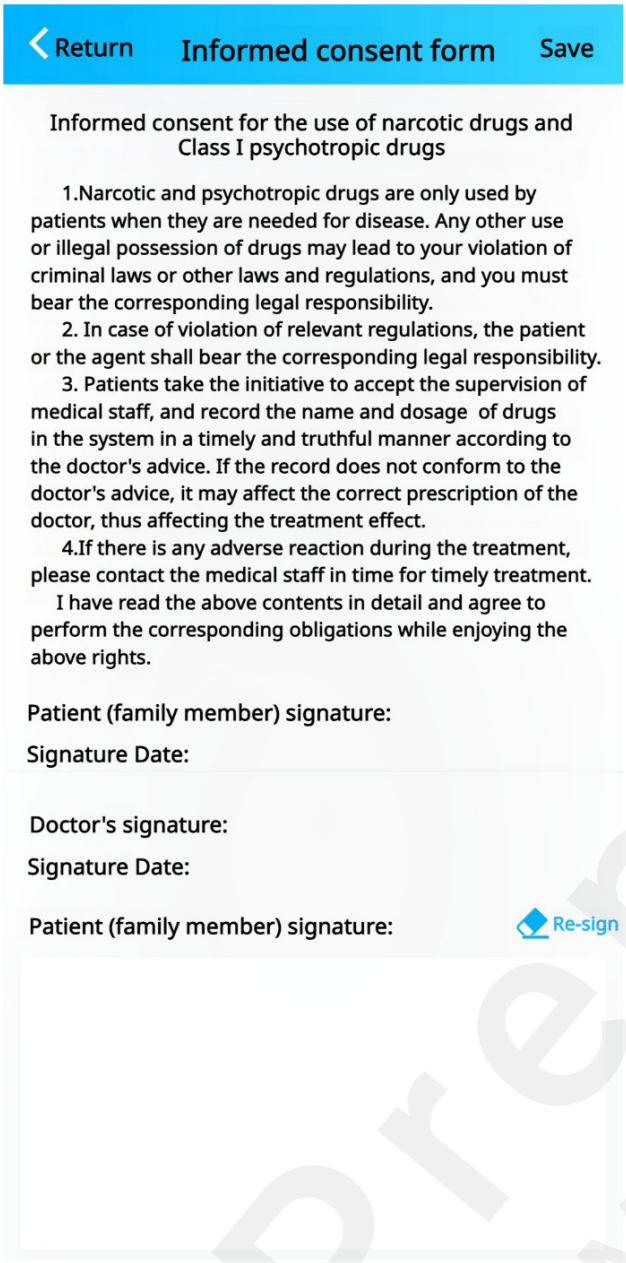


Figure 3. App-based comprehensive pain assessment

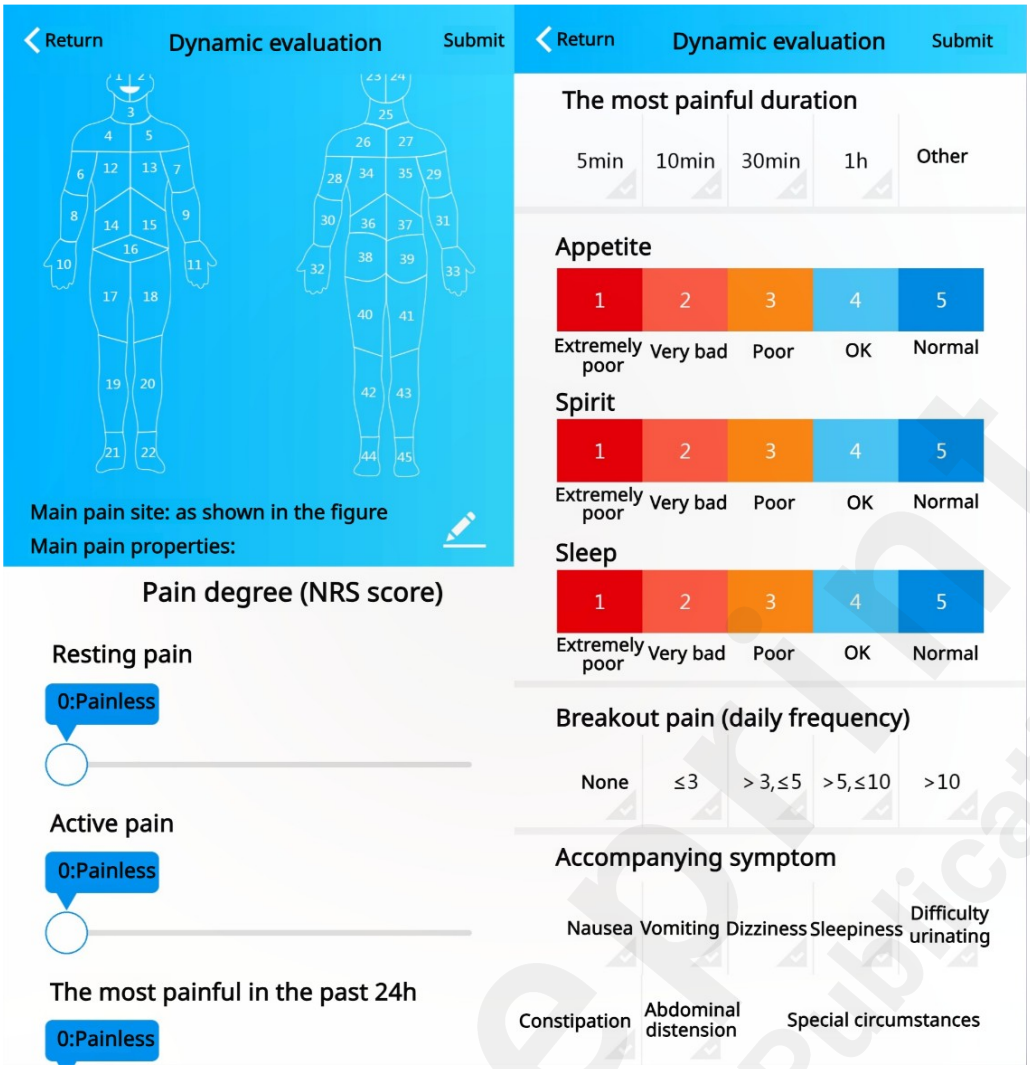


Figure 4. App-based assessment of liver and kidney function in patients

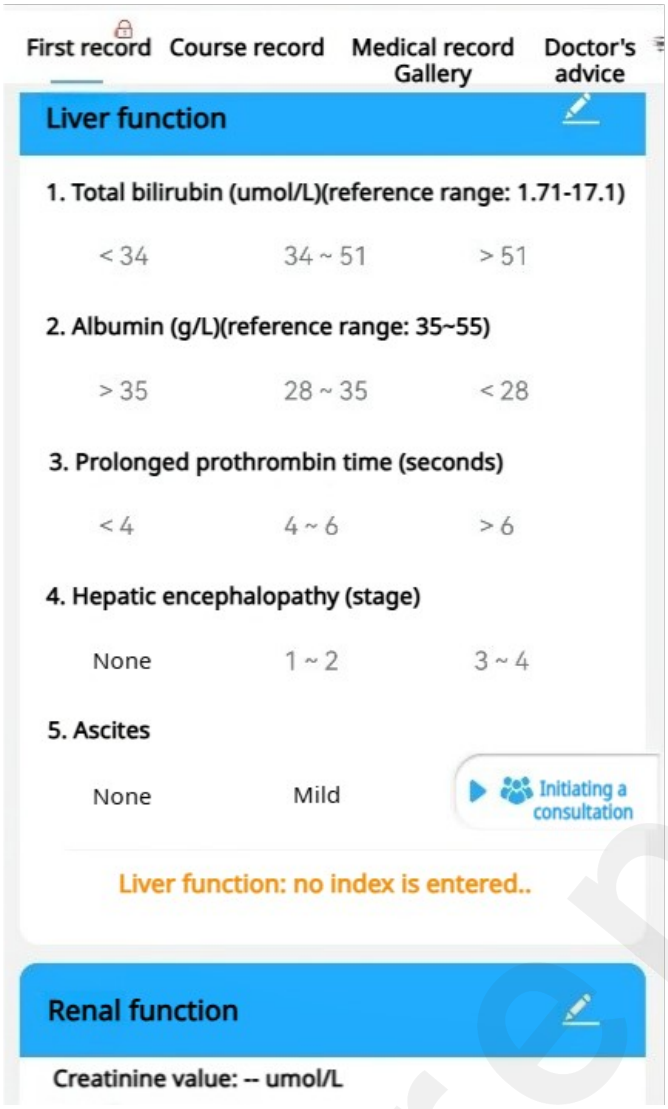
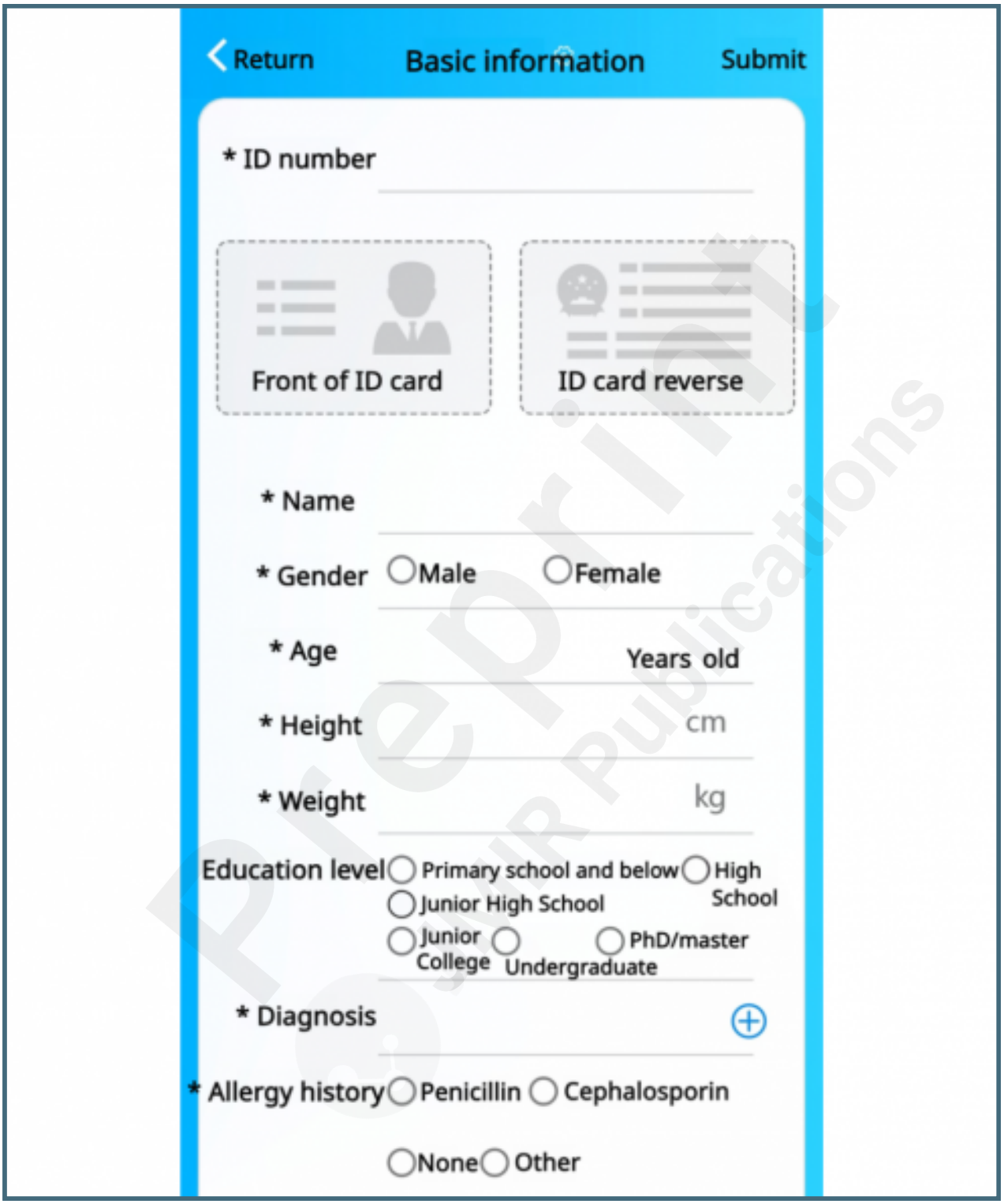


Figure 5. Schematic diagram of analgesic pump connecting gateway of cancer pain management platform

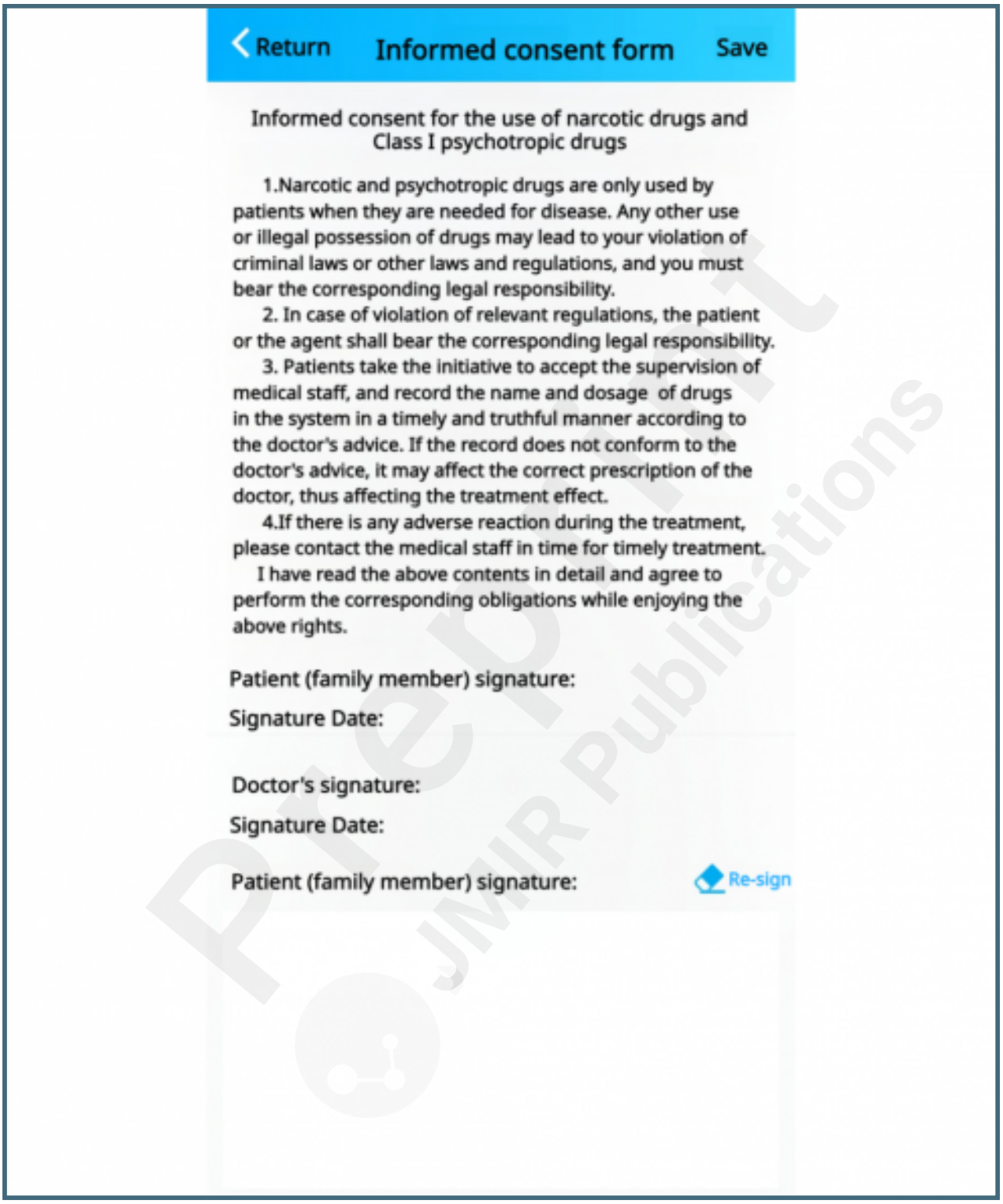
Supplementary Files

Figures

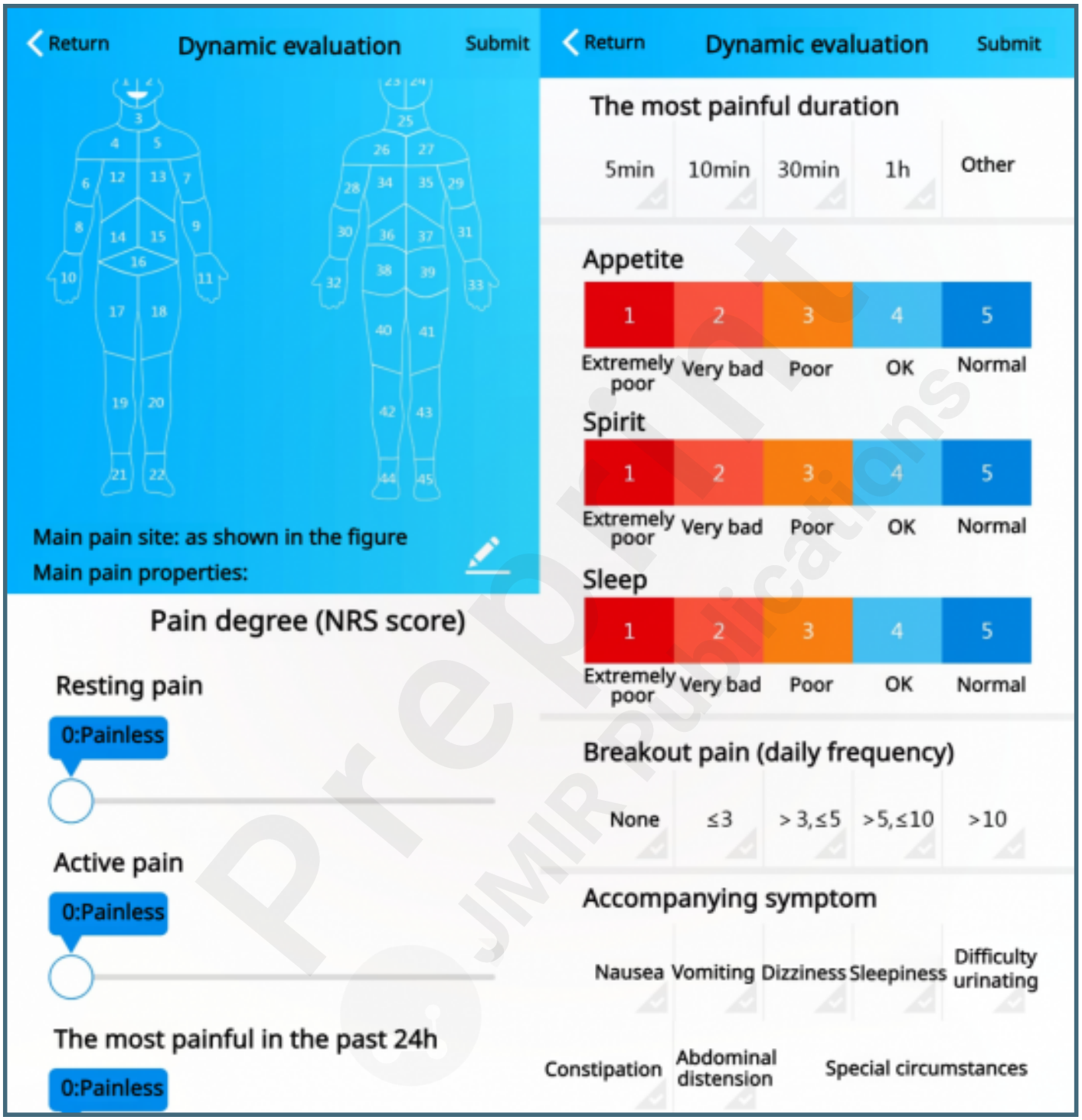
Basic patient information entry.



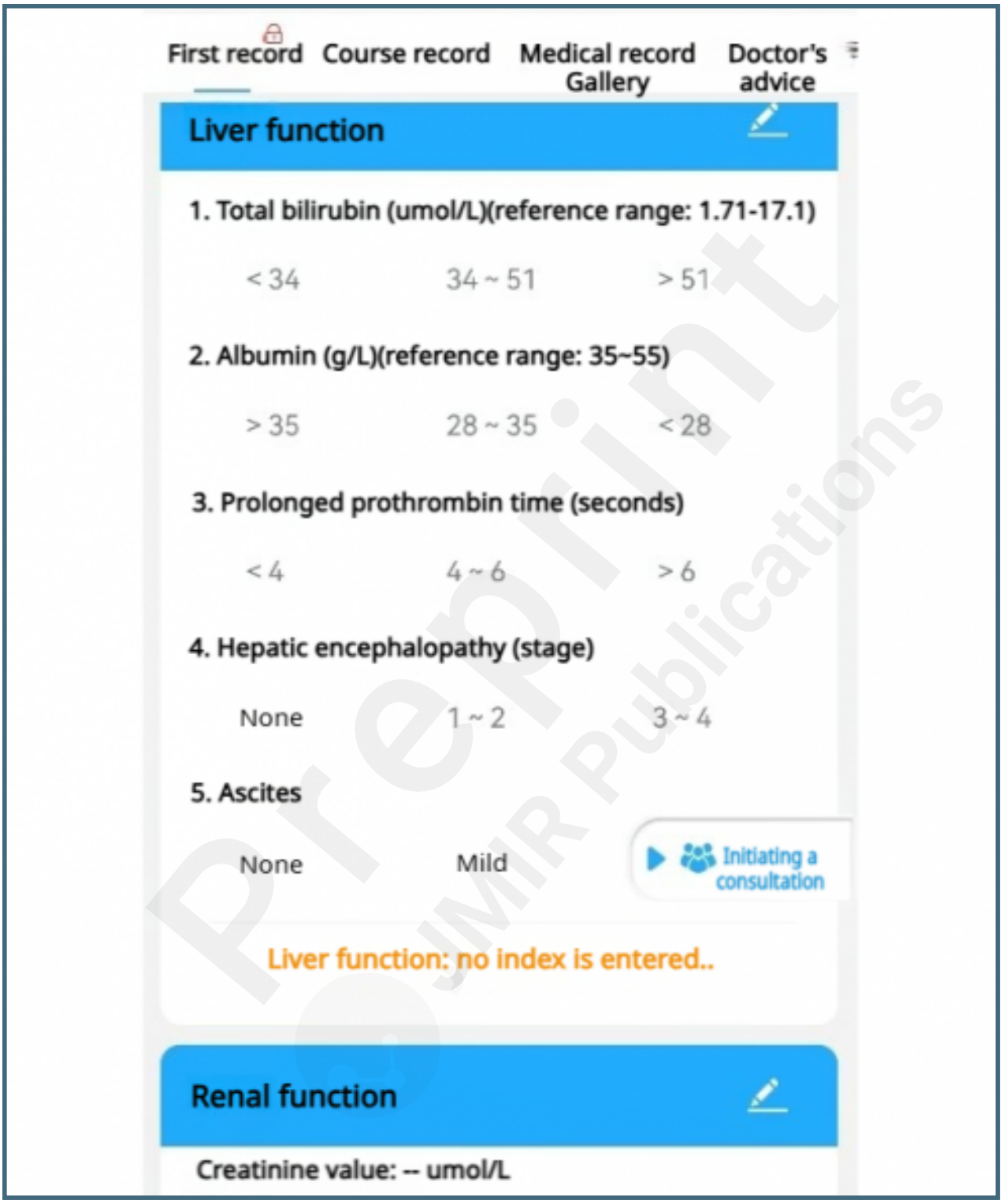
Informed consent for the use of narcotic drugs and psychotropic substances.



App-based comprehensive pain assessment.



App-based assessment of liver and kidney function in patients.



Schematic diagram of analgesic pump connecting gateway of cancer pain management platform.