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EU privacy law and B2B digital manufacturing platforms in mental health

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ABSTRACT

This study investigates the intersection of European Privacy Law (PL) and Collaborative Platforms (CP) in the context of mental health, examining their global impact on psychiatric care and the facilitation of work reintegration for individuals with mental health conditions. The research emphasizes the supportive role of PL and Business-to-Business (B2B) digital manufacturing platforms, such as CP, in enhancing the continuum of care. Specifically, it explores how these platforms can aid in societal and workplace integration for patients.

Using a quantitative methodology, the study is based on an online survey completed by 167 healthcare professionals (HCPs) specializing in mental health services and psychiatric care. The survey assesses the potential benefits of CP beyond traditional manufacturing roles, focusing on their contributions to pharmaceutical therapy development, support mechanisms, and supply chain management improvements, all under the protections afforded by PL.

The findings indicate that integrating PL with CP can significantly enhance efficiency, promote collaboration, and drive innovation in both pharmaceutical production and mental healthcare. This integration is crucial for delivering a comprehensive range of therapeutic services, including immediate crisis response and long-term rehabilitation, within a secure and legally compliant framework. The study highlights the urgent need for the development of robust governance and ethical standards to navigate the challenges and opportunities posed by CP in healthcare. It acknowledges the transformative potential of CP but stresses the necessity of a thorough examination of ethical, regulatory, and compliance issues to ensure their sustainable and ethical implementation.

1. Introduction

The convergence of Privacy Law (PL) and Business-to-Business (B2B) digital collaborative platforms (CP) represents a significant advancement in the healthcare sector, with profound implications for mental healthcare delivery. PL encompasses the regulations and principles that govern the collection, storage, and dissemination of personal information. Within the European Union (EU), the General Data Protection Regulation (GDPR) serves as a comprehensive framework ensuring stringent data protection protocols, thereby safeguarding individuals' data privacy (Abu-Elezz, Hassan, Nazeemudeen, Househ, & Abd-Alrazaq, 2020). B2B, in this context, refers to transactions between businesses that involve the exchange of services, products, or information. In healthcare, digital B2B CP facilitate these exchanges between Healthcare Organizations (HCOs) like hospitals, integrating digital tools and technologies to optimize business processes and improve patient care (McGraw, Mandl, 2021).

This development signals a paradigm shift towards the integration of technological innovations with complex privacy and legal considerations. PL, especially in the corporate realm and crucially in healthcare and patient data management, has emerged as a global regulatory focus. The recognition and protection of privacy rights vary worldwide, with the EU's explicit legal frameworks contrasting with broader constitutional interpretations elsewhere (Dillard-Wright, Shields-Haas, 2021). The innovative deployment of digital B2B CP in the hospitals, clinics, pharmaceutical and biologics sectors exemplifies the convergence of technology, innovation management, and healthcare delivery. Despite the growing interest in these platforms, their role in healthcare, particularly in fostering collaborative ecosystems for personalized mental health solutions, remains underexplored (Scuffham, 2020).

The increasing prevalence of digital technologies in healthcare presents both significant opportunities for enhancing patient care and challenges related to data privacy and security. In mental health care,

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safeguarding personal information is not just a regulatory requirement but a moral imperative, as breaches of confidentiality can lead to severe consequences, including stigma, discrimination, and potential psychological harm. CP offer transformative potential by enabling more personalized and efficient care delivery (Liu et al., 2022). They facilitate seamless collaboration among healthcare providers, enhance the management of pharmaceutical supply chains, and support innovative treatment modalities such as telemedicine and digital therapeutics. However, the legal and ethical frameworks guiding these technologies are still developing, and there is a lack of comprehensive understanding regarding how PL can be harmonized with technological advancements to ensure patient safety and trust. This issue is particularly acute given the accelerated adoption of telehealth and digital health interventions, spurred by global challenges such as the COVID-19 pandemic. The reliance on digital platforms necessitates robust legal and ethical standards to protect patient privacy while allowing the full utilization of these technologies, when it comes to different HCOs exchanging data and information between them (Murphy, Wilson, 2022).

This research addresses this critical gap by investigating the integration of PL and CP in mental health care, a field where patient data sensitivity and the need for secure handling are paramount. The primary aim of this research is to assess the influence of PL and digital CP on mental health services, with a particular focus on psychiatric care and patient work reintegration. The study specifically seeks to (1) evaluate the efficiency, collaboration, and innovation driven by these platforms in pharmaceutical production and mental health care, (2) examine the benefits and challenges associated with these technologies, and (3) identify the necessary governance and ethical frameworks for their responsible and sustainable use.

A quantitative approach was employed, involving an online survey conducted with 167 healthcare professionals (HCPs) across Europe who are actively engaged in mental health services. This methodology provides a comprehensive understanding of the current applications and perceptions of CP and PL in mental health, facilitating an in-depth analysis of their impacts on care delivery and patient outcomes.

The study's findings contribute significantly to the academic literature by elucidating the transformative potential and challenges of integrating PL and CP in healthcare. It also provides practical insights for HCPs, policymakers, and technologists, helping to navigate the complexities of these technologies in sensitive healthcare settings. By laying the groundwork for future research, policy development, and best practice formulation, this study aims to ensure that these innovations not only enhance patient care and privacy but also align with ethical standards and legal requirements.

This study is among the first to comprehensively explore this integration, offering new perspectives on the operational and ethical implications of these technologies. Future research should consider longitudinal studies and qualitative approaches to gain deeper insights into the long-term impacts and lived experiences of stakeholders involved. The implications of this study's results are far-reaching, highlighting the urgent need for healthcare systems to develop and implement robust legal and ethical frameworks that address the complexities of digital platform integration. The findings advocate for a balanced approach that maximizes technological benefits while safeguarding patient privacy and data security. By addressing these critical issues, healthcare providers can better harness the potential of digital innovations to improve patient outcomes and advance the quality of mental health care.

2. Literature review

2.1. EU privacy law

The emergence of digital technologies has profoundly transformed the EU PL landscape, particularly affecting sectors such as healthcare, digital platforms, and life sciences manufacturing. The EU leads in adapting to these changes through exhaustive legal frameworks designed to protect individual privacy, spur innovation, and facilitate information flow (McGraw, Mandl, 2021; Mulgund, Mulgund, Sharman, & Singh, 2021).

The EU stands as a pioneer in personal data and privacy protection, as evidenced by its implementation of the General Data Protection Regulation (GDPR). Presented as a testament to the EU's commitment to defending individual rights in the digital era, ensuring transparency, security, and accountability among data handlers. Nonetheless, the swift progress of digital technologies introduces new privacy protection challenges. The incorporation of digital platforms in healthcare, the expansion of life sciences manufacturing utilizing personal data, and the extensive use of mobile health (mHealth) applications are areas of significant privacy concerns. These developments call for ongoing PL and policy reassessment to protect individual rights effectively without hampering technological growth. The main issue with processing health data from a privacy standpoint is that the data being processed is sensitive and under the GDPR the requirements for processing such data are stricter (i.e. explicit consent instead of “just” consent). The challenges all come from the fact that it is a special category of data. The sector's digital transformation, including electronic health records, telemedicine, and digital health platforms, poses substantial privacy risks, such as data breaches and unauthorized information use. Similarly, the life sciences sector's reliance on data analytics and digital technologies for research prompts ethical and legal questions about consent and the balance between innovation and privacy (Mulgund et al., 2021; He, 2022).

EU PL, particularly after GDPR's enactment, signifies a shift in legal personal data protection across digital platforms, healthcare, and life sciences. Recent discussions have broadened to include various digital health applications, reflecting the regulatory and policy environments shaping digital health in the EU. This includes new technologies like artificial intelligence, wearable devices, data analytics, and the adoption of telemedicine and virtual care, highlighting digital health's increasing integration into EU healthcare systems. Furthermore, the conceptual foundation of EU PL rests on data protection principles, the right to privacy, and the necessity for technological neutrality (Tombul, Tillmann, & Andert, 2023). Comparative studies reveal differences in e-health legal standings across EU nations, emphasizing the interoperability challenge within national healthcare systems. Meanwhile, the evaluation of privacy perceptions in the digital era, questioning the adequacy of current legislation in protecting privacy amidst rapid technological advances is growing. Despite considerable progress, literature gaps exist, especially concerning PL's practical implementation challenges and adaptability to future technological innovations (Mulgund et al., 2021).

The literature on EU PL denotes an evolving field, striving to reconcile individual privacy rights protection with digital healthcare innovation benefits. While the GDPR has marked significant achievements, challenges persist in ensuring these regulations' effective implementation and adaptation to technological advancements. Future research should delve into these implementation hurdles, evaluate current regulations' innovation impact, and identify best practices for harmonizing privacy protection with technological progress (Mulgund et al., 2021; He, 2022).

2.2. Digital B2B platforms in healthcare and pharmaceuticals manufacturing

The integration of digital B2B platforms with the healthcare industry, particularly in pharmaceutical manufacturing and mental health hospital settings, marks a rapidly evolving area of research. Digital transformation in these sectors signifies a profound operational, supply chain, patient care, and service delivery shift. Digital transformation signifies a fundamental operational and value delivery shift across sectors. In healthcare and pharmaceutical manufacturing, this shift is propelled by technological progress, the pressing need for responsive healthcare solutions, regulatory demands, and a global move toward personalized,

efficient patient care. Herein, digital B2B platforms stand out as essential instruments for digital process integration, data exchange enhancement, and healthcare ecosystem collaboration promotion (Segato, Marzullo, Calimeri, & De Momi, 2020; Wani, Naeem, & Aftab, 2022; Bhattamisra et al., 2023).

In healthcare settings, notably in mental health and hospitals, digital B2B platform adoption can revolutionize patient management, treatment delivery, and overall experience. These platforms offer streamlined operations from scheduling to telemedicine, improving mental health service accessibility and quality. In pharmaceutical manufacturing, they enhance supply chain resilience and efficiency, ensuring swift, reliable medication delivery through improved stakeholder collaboration (Silva, de Carvalho, Castagna, do Rocio Strauhs, & Piekarski, 2022). However, the journey of digital transformation faces significant hurdles, including privacy concerns, cybersecurity risks, and regulatory compliance challenges. The specific application and impacts of digital B2B platforms in mental health services and pharmaceutical manufacturing remain underexplored, signaling a need for deeper investigation. Digital B2B platforms are crucial for transitioning towards more integrated, efficient, and potentially developing new healthcare models. They enable seamless stakeholder interactions, thus improving healthcare service coordination and drug production efficiency. In mental health and hospital contexts, these platforms facilitate improved care accessibility and quality through enhanced medical records and patient engagement management. They provide accurate, timely data for better decision-making and contribute to healthcare cost reduction by streamlining data processing and reducing manual intervention needs. This area's theoretical exploration is grounded in digital innovation, ecosystem theory, and value co-creation, highlighting digital platforms' role as both technological tools and systemic change catalysts (Abu-Elezz et al., 2020; Jacob Rodrigues, Postolache, & Cercas, 2020; Liu et al., 2022; Zutshi, Grilo, & Nodehi, 2021).

Research methods typically combine qualitative case studies and quantitative analyses to investigate digital B2B platforms' adoption, implementation, and impacts in healthcare. While direct studies on digital B2B platforms in pharmaceutical manufacturing and mental health are scarce, existing research underscores their transformative potential in healthcare, citing operational efficiency, patient engagement enhancement, and improved data management as primary benefits. Yet, challenges like data privacy, interoperability needs, and resistance to change among HCPs persist (Wani, Naeem, & Aftab, 2022; Abu-Elezz et al., 2020).

Overcoming these requires healthcare providers' commitment to technological investment, digital innovation culture adoption, data security prioritization, and stakeholder trust-building. Research trends indicate growing acknowledgment of digital platforms' importance in healthcare innovation. Successful digital B2B platform implementation necessitates not only technological upgrades but also organizational culture, process, and policy adjustments to maximize benefits (Zutshi et al., 2021; Silva et al., 2022).

Digital B2B platforms can be key to the healthcare and pharmaceutical manufacturing sectors' digital transformation, offering vast prospects for improving efficiency, patient care, and innovation. Despite existing challenges, their potential to overhaul healthcare delivery and manufacturing is unmistakable. Future studies should delve into the gaps identified, further examining digital B2B platforms' contribution to crafting more cohesive, efficient, and patient-centered healthcare systems (Zutshi et al., 2021; Liu et al., 2022).

2.3. Collaborative platforms (CPs)

The deployment of CP within the healthcare industry, particularly for bridging B2B digital interactions among healthcare providers, patients, and manufacturers, signifies a notable step forward in crafting personalized mental health solutions. These platforms introduce an innovative level of collaboration that breaks through conventional barriers, fostering a dynamic, patient-focused model of healthcare delivery and product development. CP stand as a pivotal shift in the approach to medical care, especially in mental health services and pharmaceutical development, leveraging digital technology to establish a common ground for interaction among healthcare stakeholders, thus enhancing transparency, efficiency, and innovation. In mental health and hospital environments, CP hold the promise of customizing treatments and care pathways to meet individual patient needs, thereby elevating the quality and personalization of healthcare services (Zutshi et al., 2021; Silva et al., 2022).

Delving deeper into the healthcare sector, especially within the sphere of B2B digital platforms, necessitates a thorough examination of the digital transformation's evolution and present scenario. This transformation encompasses more than just technological uptake; it represents a fundamental shift in the conceptualization, delivery, and optimization of healthcare services. CP are at the forefront of this shift, symbolizing the movement towards more cohesive, patient-centric, and data-informed healthcare ecosystems. Traditionally, healthcare delivery and pharmaceutical manufacturing have functioned in isolated frameworks, with scant interaction across the various sectors. Digital technology's rise, especially through the internet and mobile computing, has started to dismantle these barriers, enabling new communication forms, data sharing, and collaboration. CP have emerged as a key technology in this transformation, providing a digital infrastructure for seamless interactions among healthcare entities, and facilitating a unified healthcare ecosystem. This is especially impactful in mental health, where treatment personalization is crucial. Mental health conditions, characterized by their complex and individual manifestations, require a healthcare approach adaptable to each patient's unique needs. CP have the potential to consolidate and analyze diverse data sources to customize treatments and care pathways, thereby revolutionizing workflows, enhancing healthcare professional communication, and providing patients and manufacturers with a more active role in care processes and product development (Zutshi et al., 2021; Liu et al., 2022).

However, the adoption and effective utilization of CP, particularly in mental health and hospital contexts, are still in the early stages. The healthcare industry's intricate regulatory landscape, data privacy and security concerns, and the necessity for interoperable technology standards present substantial hurdles to CP widespread adoption. Furthermore, the shift towards collaborative, data-driven approaches within HCOs is a significant cultural change. CP in healthcare are evolving, offering vast potential to improve patient care, operational efficiency, and the collaborative creation of personalized healthcare solutions. As the digital transformation journey in healthcare progresses, CP are identified as a crucial enabler of more integrated, patient-focused healthcare ecosystems. The theoretical and methodological study of CP in healthcare is grounded in digital transformation, co-creation, and patient-centered care principles, employing mixed-methods research to evaluate the impact of CP on healthcare delivery, patient engagement, and treatment outcomes (Abu-Elezz et al., 2020; Liu et al., 2022; Zutshi et al., 2021).

The transformative potential of CP in healthcare, especially in mental health, by facilitating collaboration, enhancing patient care, and streamlining pharmaceutical processes. Yet, it also points to the complexities of integrating digital platforms into healthcare systems. The conceptualization development trajectory indicates a growing acknowledgment of CP capacity to revolutionize healthcare delivery. Insights suggest the importance of integrating CP into existing workflows, focusing on user value without overburdening healthcare providers, and developing adaptable, secure, and user-friendly platforms to support therapeutic relationships and personalized care. Thus, CP present a promising path to enhance collaboration among healthcare stakeholders and co-create personalized mental health solutions. While realizing these benefits demands careful attention to platform design, implementation,

and user engagement strategies, future research should explore innovative ways to employ CP in improving mental health care and outcomes (Sturm et al., 2020; Kouba et al., 2023).

3. Methodology

3.1. Research design

The methodological design of this study is structured to systematically explore the relationship between PL and CP, particularly their impact on mental healthcare services. Given the objective of comprehensively understanding the perceptions and experiences of HCPs regarding the integration of CP and PL in mental healthcare, a quantitative research methodology was selected. This approach is well-suited to quantify and analyze the variables of interest, allowing for the identification of patterns, trends, and associations within a large and diverse dataset. The choice of a quantitative design is also justified by the study's focus on gathering broad, generalizable data from a significant sample of professionals, which is essential for drawing robust conclusions.

The study utilized an online survey as the primary data collection tool. This method was chosen for its efficiency and practicality in reaching a geographically dispersed sample of HCPs across Europe. The survey instrument was designed to capture a range of variables, including perceptions of CP efficiency, governance and ethical considerations, and the impact of privacy laws on healthcare delivery. The structured nature of the survey allowed for consistency in data collection, facilitating reliable statistical analysis and ensuring the comparability of responses.

Quantitative methods are well-suited for identifying patterns, relationships, and trends within the data, making them ideal for assessing the impact of CP on efficiency, collaboration, and innovation (Kelly, Campbell, Gong, & Scuffham, 2020). Moreover, the use of a structured survey allows for consistency in data collection, ensuring that responses are comparable across a diverse group of respondents. This method's reliability and ability to produce generalizable results are critical in the context of exploring a relatively under-researched area (Masih, 2022).

While qualitative methods, such as interviews or focus groups, could provide deeper insights into the experiences and nuanced perspectives of HCPs, they were not used due to several reasons. Firstly, qualitative methods often involve smaller sample sizes and can be time-consuming and resource-intensive, making them less practical for capturing a wide range of opinions and experiences across Europe (Scuffham, 2020). Additionally, qualitative data's subjective nature may introduce biases and limit the generalizability of the findings (Masih, 2022). Mixed-methods approaches, combining both qualitative and quantitative data, were considered but ultimately not adopted due to resource constraints and the study's scope. The primary goal was to obtain a broad, quantifiable understanding of the perceptions and experiences related to CP and PL in mental health care, which the quantitative survey method adequately addresses (Kelly et al., 2020).

The study articulates the following research inquiries: RQ1 - In what ways do PL and digital B2B CP influence efficiency, collaboration, and innovation in the pharmaceutical manufacturing sector and mental health care services? RQ2 - How do HCPs perceive the advantages and challenges of incorporating PL and CP into mental health services? RQ3 - Which governance and ethical frameworks are essential to address the complexities posed by PL and CP in mental health care?

The study utilized a quantitative research methodology, focusing on a structured online survey to gather data from HCPs involved in mental health services. This approach allowed for the systematic measurement and analysis of specified variables, including the perceived efficiency, collaboration, and innovation fostered by CP. The survey included both closed and open-ended questions, designed to operationalize the research objectives by capturing quantifiable data on key dimensions such as the perceived benefits and challenges of CP integration, the impact on service delivery, and the influence of European PL on these platforms. The survey instrument was carefully constructed to ensure comprehensive data collection across various aspects of CP usage. It enabled respondents to provide detailed feedback on their experiences and perceptions, which is critical for evaluating the effectiveness of CP in enhancing mental health services. The collected data were subjected to statistical analyses, including descriptive statistics and correlation analyses, to explore the relationships between different variables and to identify patterns and trends.

Moreover, the survey sought to uncover the integration challenges faced by HCPs, specifically identifying the perceived benefits and obstacles of embedding CP within the current PL frameworks. This aspect of the study was crucial for understanding the practical and regulatory issues that impact the adoption and implementation of these platforms. Additionally, the research aimed to investigate the governance and ethical structures necessary for the responsible and sustainable use of CP in mental health services. This included assessing the adequacy of existing governance frameworks and identifying the elements that professionals consider essential for the successful deployment of these digital tools (Scuffham, 2020; Masih, 2022).

3.2. Questionnaire development, content, and validation process

The questionnaire's design phase emphasized establishing its framework and identifying question types most conducive to achieving the research goals. Informed by a thorough literature review, the structure employed non-probabilistic convenience sampling, chosen for its practicality in situations where securing a complete sample proves difficult. This phase targeted individuals from global corporations, guided by a conceptual map to efficiently evaluate the hypotheses. The study spanned from November 8th, 2023, to January 4th, 2024. Participants were briefed on the study's aims, scope, and evaluative criteria before survey distribution. Developed on Google Forms and inspired by preceding studies, the survey underwent validation by an expert panel comprising two specialists, a statistician, and the authors. Content development unfolded in three stages, starting with an exhaustive literature review on CP in healthcare, focusing on mental health services to pinpoint key themes and challenges. This step also ensured discussions with the two experts in mental health care, digital health technologies, and healthcare law, ensuring the questionnaire's relevance (Kelly et al., 2020; Masih, 2022).

Questions covered various domains, such as CP perceived impact on care delivery, the challenges of their integration with PL, and the required governance and ethical frameworks. The questionnaire blended quantitative and qualitative questions to encapsulate HCPs perceptions and experiences comprehensively. The questionnaire commenced with demographic and professional background questions, collecting basic information about respondents' roles, experience in healthcare, and involvement with CP, aiding in contextualizing later responses:

- Questions on the impact of PL and CP, utilizing Likert scale items to assess opinions on PL's role in CP deployment within mental health services.
- Questions evaluating efficiency and innovation, asking respondents to rate CPs' effect on service delivery efficiency and describe observed innovative practices via open-ended questions.
- Questions on perceived benefits and challenges, featuring multiple-choice items for identifying benefits and challenges in CP integration, providing insights into obstacles related to PL compliance.
- Questions regarding governance and ethical frameworks, where respondents assessed the sufficiency of current frameworks and suggested improvements through open-ended responses.
- A concluding section gauged the overall impact of CP on mental health service quality, supplemented by an open-ended query for additional comments, offering a broader perspective on CP effects.

This structured approach aimed to capture a holistic view of the HCP participants of their opinions, experiences, and attitudes towards CP in

mental health services, supporting the research objectives and according to the overview of certain variables and key connection areas.

The following table (see Table 1) delineates a synthesized framework of the research on the utilization of CP, specifically examining their intersection with PL and the implications for mental health practices. It collates key conceptual areas, variables within those areas, and the pivotal connections or findings between them. In the realm of efficiency, a positive correlation was identified between CP efficiency and the perception of PL impact, underscoring the reciprocal influence between operational efficacy and regulatory compliance. Collaboration and innovation are driven by CP capacity to foster innovative practices, with a recognized role in enhancing mental healthcare outcomes. The analysis revealed uniform perceptions of the benefits and challenges posed by CP across different professional roles, suggesting a broad consensus without substantial variations attributable to specific roles.

The development of this questionnaire aimed to comprehensively capture the impact and management of CP in mental health care, reflecting the insights of those intimately engaged with their utilization and oversight. Incorporating both quantitative and qualitative queries, the questionnaire generated a rich data pool for an in-depth examination of CP present influence and future trajectories within mental health services. A significant phase was conducting cognitive interviews with a portion of the pilot group to explore their reasoning during the questionnaire completion, aiming to uncover any potential ambiguities or misconceptions and gain insight into their interpretation of the queries. Reliability testing was another vital component, where pilot data were analyzed using Cronbach's alpha to evaluate the questionnaire's internal consistency, ensuring that similarly themed questions yielded consistent responses. Based on the outcomes of the pilot test with two experts selected due to the proximity to the research team and cognitive interviews, necessary amendments were implemented to refine the questionnaire's clarity, relevancy, and flow. Finally, the concluding expert assessment with the two individuals initially part of the preliminary validations, ensured the revised questionnaire's content validity and deployment readiness. Through this rigorous development and validation methodology, the questionnaire was crafted as a dependable instrument for investigating the intricate interplay of CP usage in mental health services, guaranteeing that the derived insights are both reliable and conducive to informed action (Kelly et al., 2020; Masih, 2022).

3.3. Sampling strategy

This research targeted a heterogeneous group of participants, including psychiatrists, psychologists, mental health counselors, healthcare administrators, and policymakers active in the mental health arena based in Europe. The inclusion criteria were designed to encapsulate a broad spectrum of viewpoints concerning the utilization and oversight of CP. The selection of 167 respondents to evaluate the effects and integration hurdles of CP in mental health services was carefully strategized to guarantee representation, diversity, and alignment with the study's aims, involving several steps as detailed below. Initially, the target demographic was identified as HCPs engaged in providing mental health services, which spanned psychiatrists, psychologists, mental health counselors, healthcare administrators, nurses, and policymakers experienced in digital health technologies, especially CP.

The choice of 167 respondents for this study was deliberate and carefully considered, drawing on established methodologies from similar studies. The selection aimed to ensure a broad and representative sample of HCPs involved in mental health services across Europe. This sample size was determined using power analysis, which accounts for the expected effect size, a standard significance level (alpha = 0.05), and a desired statistical power of 0.80. This calculation ensures sufficient power to detect meaningful differences or relationships in the data, thereby enhancing the study's validity and reliability.

Similar studies have employed comparable sample sizes to explore HCPs attitudes and perceptions, particularly in specialized fields such as mental health (Kelly et al., 2020; Masih, 2022). For example, research by Kelly et al. (2020) used a sample of 150 HCPs to investigate digital health tools' adoption, which provided robust and generalizable findings. In another study, Masih (2022) examined the integration of technology in healthcare settings with a sample of 180 respondents, demonstrating that such sample sizes can yield comprehensive and reliable insights.

While larger sample sizes can enhance the robustness of statistical analyses, the selection of 167 respondents was balanced against practical considerations such as resource constraints and the availability of eligible participants. Alternatives such as qualitative interviews or mixed-methods approaches were considered but ultimately not pursued due to their resource-intensive nature and the study's focus on quantifiable data. Qualitative methods, while valuable for in-depth insights, typically involve smaller sample sizes and cannot provide the breadth of data required for the statistical analysis employed in this study. Mixed-methods, combining both qualitative and quantitative approaches, could have offered a richer data set but were beyond the scope due to time and resource limitations.

Furthermore, the use of an online survey allowed for efficient data collection from a geographically diverse group of HCPs, ensuring a wide range of perspectives were captured. Considering the digital focus of the study, an online methodology was selected as the most effective means to engage a broad and varied audience of HCPs. Primary channels for identifying potential respondents included professional associations, online forums, social media groups tailored to HCPs, and networks linked to digital health innovations. To ensure a comprehensive representation of different subgroups within the target demographic, a stratified random sampling method was applied, with strata delineated based on professional role, CP experience level, and geographical location, reflecting diversity in healthcare systems and privacy legislation implications.

Random selection within each stratum for study invitations aimed to reduce selection bias and bolster the findings' applicability. The sample size of 167 respondents, determined via power analysis, accounted for the expected effect size, a significance testing alpha level of 0.05, and a power of 0.80, confirming the study's capacity to identify significant differences and correlations. Recruitment was executed through direct email invitations, posts on pertinent online platforms, and partnerships with professional associations in the mental health domain. Invitations clarified the study's objectives, the anonymity and confidentiality of participation, and the estimated questionnaire completion time. The

Table 1
Conceptual areas with key variables and key connections.

Conceptual Area	Variables	Key Connections
Efficiency impact	CP efficiency, PL impact	Positive correlation between CP efficiency and perception of privacy law impact
Collaboration & innovation	Innovative CP practice, CP benefit	Role of CP in promoting innovation and perceived benefits in mental health care
Perceived benefits & challenges	CP benefit, integration challenge	Uniform perceptions of benefits and challenges across roles; no significant associations
Governance & ethical frameworks	Governance and ethical frameworks	Mild positive correlation with CP efficiency; no role-based differences in perceptions
Professional role	Role	No significant differences in perceptions across roles regarding CP and governance
Healthcare workers' perceptions	CP impact, comments	Negative correlation between CP efficiency and overall impact
Statistical significance & effect	Cohen's d, eta squared	Small effect sizes indicate minimal practical significance despite statistical significance

study emphasized its potential to enhance CP utilization in mental health services to motivate participation.

Respondents were required to meet specific inclusion criteria:

- Current employment as a healthcare professional within the mental health sector.
- Direct experience or knowledge of CP in a professional setting.
- Ability to provide informed consent for study participation.

Exclusion criteria were established to maintain the study's focus and pertinence:

- Professionals outside the healthcare sector.
- HCPs unengaged in mental health services.
- Individuals lacking access to or familiarity with CP professionally.

This detailed sampling strategy aimed to collect insights across a wide range of HCPs, ensuring the results accurately reflect the varied experiences and perspectives on CP in mental health services.

3.4. Data collection and analysis procedures

The methodology for collecting data was organized to facilitate the effective deployment of the questionnaire and to safeguard the integrity and caliber of the data gathered. The process from administering the questionnaire to implementing data quality assurance measures is detailed below. Initially, the questionnaire was disseminated via an online survey platform (Google Forms and Gmail), chosen for its accessibility to respondents, streamlining data collection. This platform was selected due to its secure, user-friendly nature, and compatibility with various technological preferences among participants. In the phase concerning invitation and consent, potential participants were sent an email detailing the study's purpose, the time commitment required, and a link to access the online questionnaire. This communication also emphasized the voluntary nature of participation, and confidentiality assurances, and included a consent form that needed acknowledgment before proceeding to the survey questions. To enhance response rates, reminder emails were dispatched two weeks following the initial invitation to those who had not yet completed the questionnaire, highlighted the value of their contribution, and reiterated the privacy of their responses.

A feature allowing participants to save their progress and return to finish the survey later was implemented to decrease incomplete responses and foster thorough responses to open-ended questions. Additionally, data validation rules were applied to specific question types to maintain data accuracy, ensuring numerical fields were correctly filled and mandatory questions were not overlooked. Respondent anonymity and confidentiality were prioritized to encourage genuine responses and minimize bias. No identifiable information was collected, with data stored securely and accessible only to the research team. Upon data collection, initial quality assessments were conducted to rectify any inconsistencies, duplicates, or anomalies, reviewing response distributions and cross-tabulating variables to identify potential misunderstandings or non-serious responses. These extensive data collection and quality control measures aimed to amass high-quality, reliable data from HCPs about their use and perspectives on CP in mental health services.

For data analysis, quantitative responses were evaluated using statistical techniques suited for cross-sectional designs, such as Independent t-tests to compare CP perceptions across different professional roles, ANOVA for examining differences in perceived efficiency, collaboration, and innovation based on CP experience levels, and chi-square tests for investigating relationships between categorical variables like perceived CP benefits/challenges and participants' professional backgrounds. Qualitative data will undergo thematic analysis to extract prevalent themes and narratives related to CP integration, PL challenges, and necessary governance and ethical frameworks.

Regarding the confidence intervals (CIs) construction, they are a range of values used to estimate the true value of a population parameter. In the context of the correlations presented in the study, confidence intervals provide an estimate of the range within which the true Pearson correlation coefficient is likely to lie, with a certain level of confidence (typically 95%).

The construction of confidence intervals for the correlation coefficients involved several steps. First, the sample Pearson correlation coefficient (r) was calculated for each pair of variables, measuring the strength and direction of the linear relationship between them. Since the sampling distribution of r is not normally distributed, especially when r is far from zero, Fisher's Z-transformation was applied to approximate a normal distribution. This transformation is defined as $Z = \frac{1}{2}\ ln(\frac{1+r}{1-r})$ where ln represents the natural logarithm. The transformation stabilizes the variance and normalizes the distribution of the transformed correlations.

Next, the standard error (SE) of the Z-score was calculated using the formula $SE = \frac{1}{\sqrt{n-3}}$ where n is the sample size. This accounts for the sample size's effect on the precision of the correlation estimate. To construct the confidence interval on the Z-scale, the formula $CI = Z \pm Z_{\alpha/2} * SE$ was used, where $Z_{\alpha/2}$ is the critical value from the standard normal distribution (for instance, 1.96 for a 95% confidence level).

The final step involved transforming the CI limits back to the original correlation scale using the inverse Fisher Z-transformation: $r = \frac{e^{2Z}-1}{e^{2Z}+1}$ where e is the base of the natural logarithm. The resulting interval provides a range within which the true population correlation coefficient is expected to lie with 95% confidence. This methodology ensures that the confidence intervals account for the sample size and the distribution characteristics of the correlation coefficient.

4. Results

4.1. Demographic and descriptive statistics overview

The survey garnered responses from a varied demographic of HCPs, predominantly from the age groups of 26–35 and 51–60, with the majority identifying as female. The professional roles of participants spanned the healthcare spectrum, notably including physicians/psychiatrists and nurses/nurse practitioners, with a substantial portion having 11–20 years of experience.

To provide a detailed examination, the initial step involved analyzing and visualizing the data for each variable individually, emphasizing key statistical insights, and generating graphs to facilitate advanced analytical exploration. Additionally, the analysis considered external factors that might influence responses, such as recent technological advancements in PL or changes in regulations impacting CP. Recognizing the significance of governance and ethics, a thorough review of current policies and guidelines was suggested to be augmented with expert interviews or a Delphi study for a consensus on best practices.

For variables with a qualitative nature, such as Innovative CP Practice, CP Benefit, Integration Challenge, and improvement suggestions, the approach began with descriptive analysis to pinpoint common themes and frequencies. Regarding the quantitative dimensions, including Governance and Ethical Frameworks and CP impact, summary statistics were calculated, and the distribution of responses was visually represented, offering a multifaceted perspective on the data.

The survey encompassed responses from 167 HCPs, showcasing a broad demographic range. Predominantly, the respondents fell into the age categories of 26–35 and 51–60, with females constituting roughly 63% of the sample. The distribution of professional roles included

physicians/psychiatrists, nurses/nurse practitioners, among other healthcare positions, primarily boasting 11–20 years of experience in the sector.

The descriptive analysis focusing on Innovative CP Practice identified the recurrence of specific innovative practices as reported by participants. The practices most frequently mentioned were "Teletherapy and Virtual Consultations" and "Real-Time Crisis Intervention," each garnering 24 mentions. Close behind were "Community and Peer Support" with 21 mentions, and "Continuous Professional Development" along with "Regulatory Compliance and Privacy Assurance," each receiving 20 mentions. These findings underscore a concentrated emphasis on digital interactions, crisis response, community engagement, professional development, and adherence to regulations as pivotal innovation areas within CP for mental healthcare and patient reintegration.

The following figure (see Fig. 1) delineates the age distribution across genders, where a striking feature of this distribution is the prominence of the masculine gender across all age brackets, with a notable peak in the 51–60 age range. This peak could suggest a significant representation of experienced professionals who may be the primary users of CP. Conversely, the feminine gender shows a less pronounced but consistent presence across age groups, with a slight increase in the 36–40 range. The 'I prefer not to answer' category, while modest, is present in all age groups, indicating a degree of privacy concern that may be reflective of the attitudes toward the EU PL. This presence underscores the necessity to consider privacy preferences and the potential impact on mental health when engaging with digital platforms.

In evaluating the impact of the EU PL on B2B digital CP, it is essential to consider how privacy concerns may influence user participation across genders and age groups, and subsequently, how this participation—or lack thereof—affects mental health outcomes. The chart suggests that while older age groups, particularly masculine-identifying individuals, are currently the most engaged, there is a demographic spread that should be accounted for when assessing platform design, privacy policies, and mental health support systems.

In the following figure (see Fig. 2), the age distribution among various professional roles is potentially useful for analyzing the influence of PL on CP. The data exhibits a substantial representation of Physicians/Psychiatrists and Mental Health Specialists across nearly all age groups, with a noticeable concentration in the 51–60 age cohort. This suggests a mature workforce, possibly indicating a depth of experience in the implementation and utilization of CP in mental health practices. General Practitioners and Nurses/Nurse Practitioners are well-represented in the younger age groups, particularly 26–35, reflecting perhaps an early career engagement with digital health tools. Interestingly, the presence of Policy Makers peaks within the 41–50 and 61–66 age ranges, implying the involvement of established professionals in shaping policy around digital platforms and mental health, from Europe. Healthcare Administrators and Psychologists are evenly distributed, though less represented than other roles, which could highlight a potential area for increased integration of these professions into CP usage. The implications of these findings are multifaceted.

The distribution across ages suggests that while there is a strong foundation of experienced professionals engaged with digital tools, there is also a generational diversity that could influence the adoption and shaping of CP. The variation in representation amongst roles also underscores the need for interdisciplinary collaboration and training to optimize the use of digital platforms under the EU PL, ultimately aiming to enhance mental health outcomes.

Subsequent analysis delved into the CP Benefit to decode the benefits recognized by users of collaborative platforms. "Improved patient engagement" emerged as the top benefit, acknowledged by 77 respondents. This was followed by "Enhanced inter-professional collaboration" with 38 mentions, and "Better treatment personalization" and "Increased accessibility to services," each cited by 19 respondents.

These insights reveal HCPs appreciation for CP in boosting patient participation and promoting collaboration among healthcare workers, besides personalizing treatments and expanding service access. An exploration into the Integration Challenge encountered in adopting these platforms was also conducted. The examination of the Integration Challenge pointed to "Data security concerns" as the foremost hurdle, identified by 96 participants, signaling widespread apprehension regarding patient data security on collaborative platforms. The "Complexity of regulations" was noted by 31 respondents, underscoring the challenges faced in navigating through regulatory landscapes. "Lack of clear guidelines" and "Technical integration issues" were each mentioned by 19 respondents, indicating the necessity for more explicit guidelines and improved technical support for integrating these platforms effectively.

4.2. Statistical analysis

The analysis commenced with summarizing the overall impact assessments of CP through descriptive statistics, focusing on the central tendencies and dispersion of responses to gauge the general sentiment. For the 'Governance and Ethical Frameworks' rating, the average score of 3.41 reflects a moderate approval level among respondents, with a Standard Deviation of 1.20 indicating varied opinions. In contrast, the

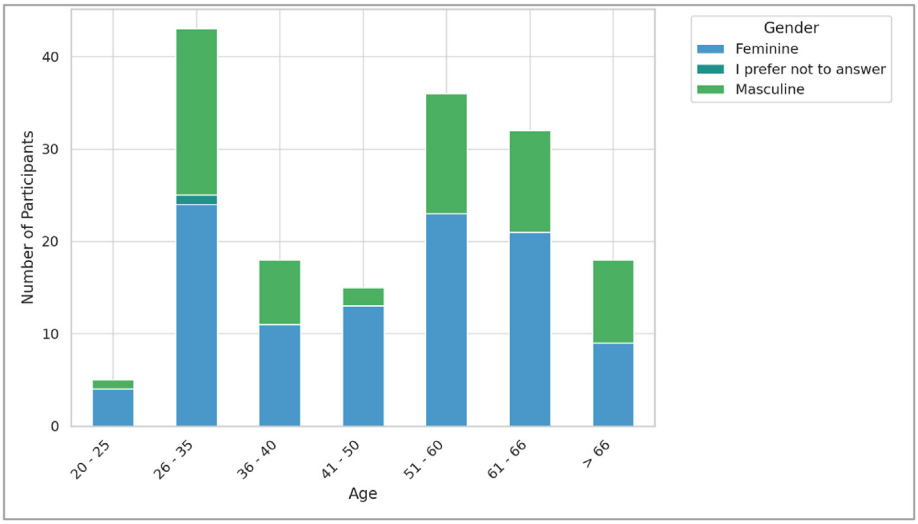

Fig. 1. Age distribution by gender.

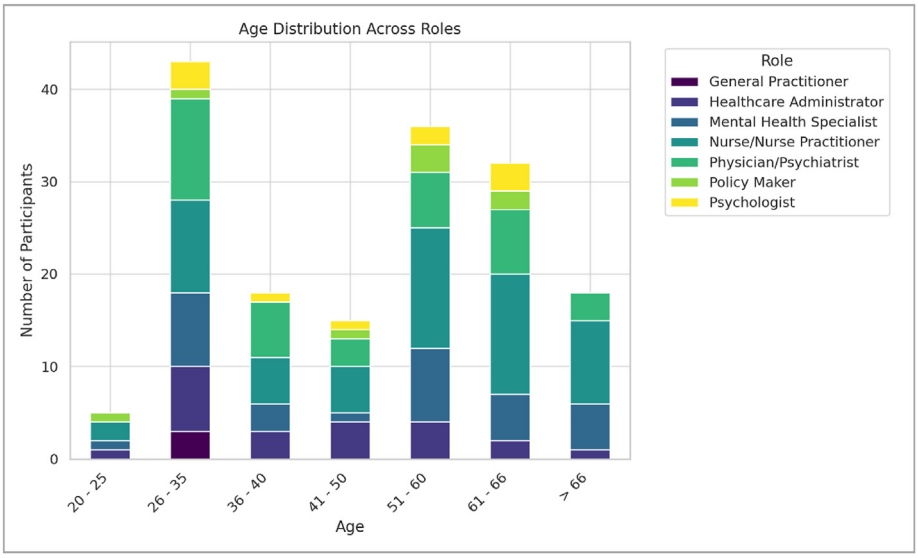

Fig. 2. Age distribution across roles.

'CP Impact' rating, with an average of 4.02, demonstrates a favorable perception of CP impact, and a lower Standard Deviation of 0.82 points to more consensus among respondents regarding their positive effect. These findings reveal a predominantly positive view on the impact of CP, with a notable inclination towards higher ratings for their influence. However, the moderate satisfaction levels regarding governance and ethical frameworks, with a common rating of 3, suggest potential areas for enhancement to bolster confidence in these systems.

The statistical analysis deployed included confidence levels, viability, and credibility tests, followed by correlation analysis to uncover relationships between efficiency, collaboration, innovation perceptions, and variables like perceived benefits and challenges. This analysis aimed to determine if higher efficiency perceptions correlate with specific benefits or challenges identified by respondents. Subsequent phases involved Chi-square Tests for categorical variables to pinpoint trends in perceived benefits and challenges, revealing significant associations between these perceptions and CPs' efficiency. Independent t-tests and ANOVA were conducted to examine differences across various demographics for continuous variables, particularly within the 'Governance and Ethical Frameworks' domain, considering the categorical nature of demographic variables such as age and gender (see Fig. 3).

Fig. 3 elucidates the correlation matrix for a survey conducted among HCPs assessing the impact CP within the context of EU PL. This visual analytical tool inspects the relationship between CP Impact, CP Efficiency, Governance and Ethical Frameworks, and PL Impact Numeric. The most salient feature of the heatmap is the moderately positive correlation between CP Impact and CP Efficiency, with a coefficient of 0.31, indicating a synergistic relationship; as perceptions of CP impact

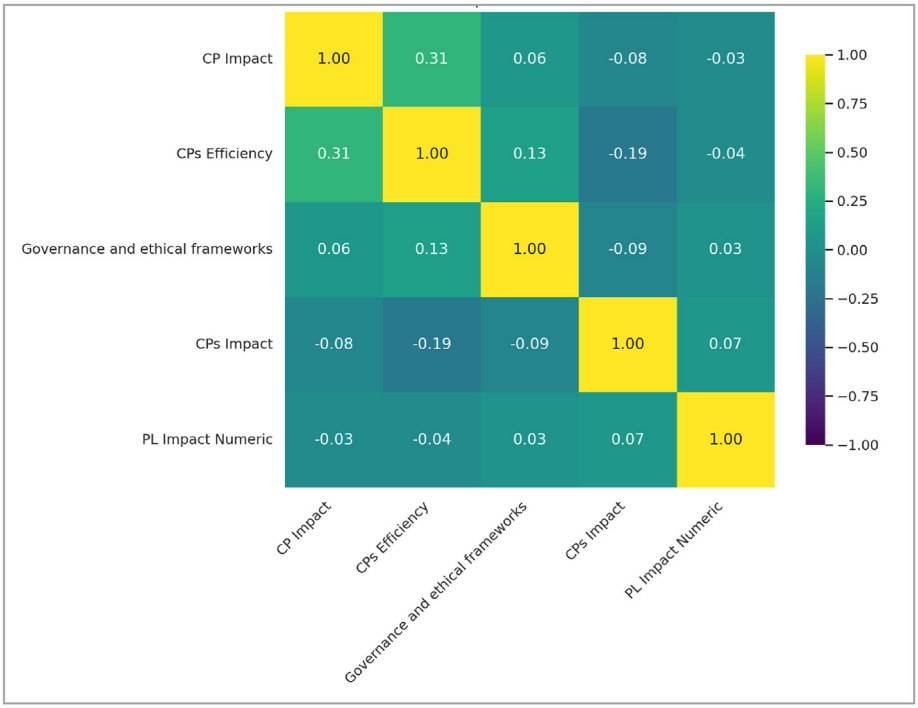

Fig. 3. Heatmap of the correlation matrix.

increase, so does the perceived efficiency of these platforms. Conversely, a mild negative correlation is observed between CP Impact and CP Efficiency, indicating that as the impact of CP on practice increases, the perceived efficiency does not necessarily follow. Further analysis reveals negligible correlations between PL Impact Numeric and other variables, suggesting that the numeric representation of PL impact does not have a strong linear relationship with perceptions of CP impact or efficiency, nor with the governance and ethical frameworks in place. The muted correlations involving Governance and Ethical Frameworks, particularly its weak correlation with CP Efficiency (0.13) and near-zero correlation with PL Impact Numeric (0.03), might imply that the regulatory and ethical considerations have a subtle, if any, influence on the efficiency and effectiveness of CP as perceived by the participants.

The analysis suggests that while certain factors may be perceived as interconnected, they do not necessarily predict one another in a manner that would simplify the interpretative framework for healthcare policymakers and administrators aiming to optimize psychiatric care and work reintegration.

The correlation matrix (see Fig. 4) represents the interrelations between key variables pertinent to a survey on CP in the healthcare sector. This survey examines CPs' efficiency, their governance and ethical frameworks, and CPs' overall impact on healthcare practices. Red tones in the heatmap denote positive correlation coefficients, while blue tones represent negative correlations, with the intensity of the color correlating to the strength of the relationship. Notably, CPs' efficiency is moderately negatively correlated with CPs' impact (−0.19), suggesting that increased perceptions of CPs' impact might not align with enhanced efficiency or could signify that greater impact is associated with recognition of inefficiencies. The correlation between CPs' efficiency and governance and ethical frameworks is weakly positive (0.13), implying a slight association where stronger governance might be perceived as contributing marginally to efficiency. Moreover, the minimal negative correlation between CPs' impact and governance and ethical frameworks (−0.09) suggests that stricter governance does not significantly affect the perceived impact of CP. These relationships underscore a complex dynamic, where governance structures and perceived impact and efficiency of CP interplay do not exhibit strong linear dependence. Understanding these correlations is vital for decision-makers and stakeholders in healthcare to discern how collaborative technologies might be optimized and governed effectively. These insights can inform strategic initiatives to bolster the integration of CP within healthcare practices, ensuring they complement the ethical and governance standards without compromising efficiency and impact.

The correlations depicted in Figs. 3 and 4 were constructed using Pearson's correlation coefficient. This statistical measure evaluates the strength and direction of the linear relationship between two continuous variables. For each pair of variables, the Pearson correlation coefficient (r) ranges from −1 to +1. An r value of +1 indicates a perfect positive linear relationship, −1 indicates a perfect negative linear relationship, and 0 suggests no linear relationship. Pearson's correlation was applied to assess relationships between variables such as CP efficiency, CP impact, governance and ethical frameworks, and the perceived influence of PL. The calculation of these correlations was based on survey responses, where participants rated these aspects on a Likert scale or similar continuous scale. The correlation matrix in Fig. 3 and the heatmap in Fig. 4 both visually represent these Pearson correlation coefficients. The

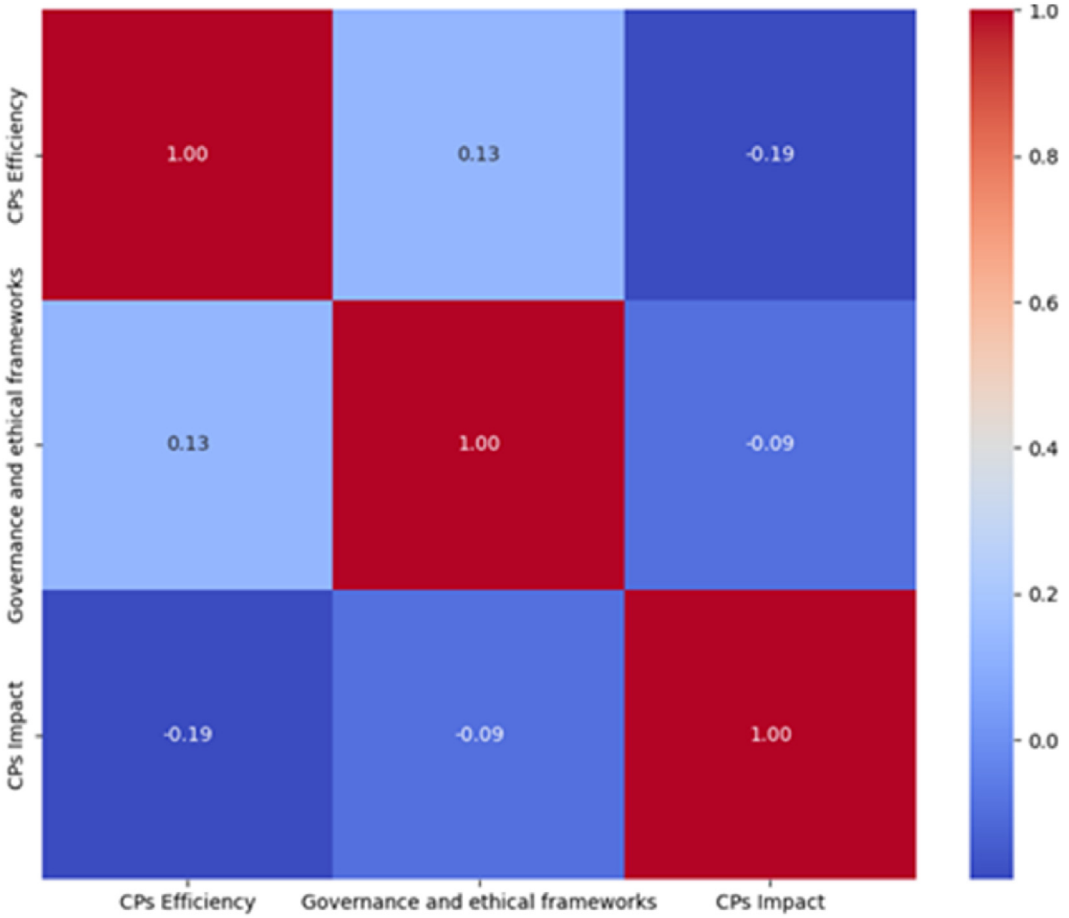

Fig. 4. Correlation Matrix between key variables.

heatmap, in particular, uses color gradients to indicate the strength and direction of the correlations, with warmer colors typically representing positive correlations and cooler colors indicating negative correlations.

These correlations specifically measure the linear relationships between the variables. If the relationships are non-linear or involve more complex interactions, these would not be captured by Pearson's correlation and would require different analytical methods to explore. Lastly, descriptive statistics and thematic analysis were applied to the 'CP Impact' and additional comments to summarize the overall impact assessments and glean further insights. This multifaceted analytical approach highlights a generally positive attitude towards CP among HCPs, with emphasis on the upper end of the rating scale, and underscores the need for further investigation into governance and ethical framework improvements.

4.2.1. Confidence levels, viability, and credibility

The analytical approach adopted for this study aimed to provide a nuanced interpretation of statistical outcomes, incorporating p-values, confidence intervals, and effect sizes, and evaluating the robustness of the statistical methodologies utilized. These elements were critical in determining the findings' reliability and generalizability. A standard confidence level of 95% was employed across many scientific inquiries, signifying the likelihood that the interval estimate encases the actual population parameter, thereby offering an estimated range for the true population mean or effect size derived from the sample data.

The term "viability" refers to the practical relevance or applicability of the study findings in real-world scenarios, largely involving the assessment of effect size to determine the strength of variable relationships or the magnitude of group differences. "Credibility" pertained to the consistency (reliability) and accuracy (validity) of the study outcomes, with considerations for sample size, sampling methodology, and controlling confounding factors influencing this aspect. Upon conducting correlation, ANOVA, and chi-square tests, preliminary analyses of confidence intervals and direct effect size measurements were provided. For correlation analysis, the correlation coefficient (r) highlighted the linear relationship strength and direction between two variables. The confidence interval around r offered reliability insights for this relationship. The p-value associated with the correlation coefficient evaluated the credibility of the observed correlation, denoting statistical significance. Nevertheless, correlation alone does not establish causality.

Regarding ANOVA, results comprised F-statistics and p-values, with confidence intervals around mean differences elucidating potential population mean ranges. The effect size in ANOVA (e.g., η^2) represented the variance portion attributed to the independent variable, enhancing the findings' practical significance.

For chi-square tests, the confidence level correlated with the p-value, indicating the chance likelihood of observed associations. The effect size in chi-square tests (e.g., Cramer's V) denoted the association strength between categorical variables, adding to the test's practical significance. Further analytical enhancement involved calculating confidence intervals for mean differences in ANOVA or proportions in categorical analyses, offering deeper reliability insights into these differences. Direct assessment of effect sizes provided a clearer view of the findings' practical significance. Post-hoc analyses in ANOVA identified specific group differences.

In correlation analysis between CP efficiency and Governance and Ethical frameworks with a coefficient (r) of 0.131, Fisher's Z transformation steps were followed for confidence interval calculation. The ANOVA effect size calculation assessed the practical significance of the findings. Visualizations for CP Efficiency, Governance, and Ethical Frameworks, and CPs' Impact through a heatmap underscored the relationships among these variables, confirming mild positive and negative correlations. A detailed ANOVA on the variable of interest was explored further, especially focusing on governance and ethical frameworks' impact across different professional roles. Despite ANOVA results indicating no significant differences ($p = 0.314$), the calculation of η^2 (eta squared) for ANOVA across roles approximated 0.043, suggesting a small but significant variance amount explained by the professional role in governance and ethical frameworks' perceptions. This analysis, including correlation visualization, ANOVA, and effect size determination, provided a detailed understanding of the data. While no statistically significant differences in governance and ethical framework ratings across roles were found, a minor variance proportion attributable to professional roles was noted. These insights contribute to a broader understanding of PL and CPs' impact, benefits, and challenges in mental health care, emphasizing governance and ethical considerations in their integration.

For 'PL Impact', a confidence interval ranging approximately from 3.61 to 3.80 at a 95% confidence level indicated a high precision level in estimating the population means. The viability of the results, suggested by a very small Cohen's d effect size, indicated the minimal practical difference between compared groups, necessitating a cautious interpretation of statistical significance versus practical relevance.

4.2.2. Correlation analysis

A correlation analysis was conducted to elucidate the relationships between CP Efficiency, Governance, and Ethical Frameworks, and CP impact, shedding light on how the efficiency and governance of platforms correlate with their overall impact in mental health contexts. The analysis revealed a mild positive correlation between CP efficiency and Governance and Ethical Frameworks ($\rho = 0.132$), indicating a slight alignment where perceptions of higher efficiency mildly coincide with more favorable views on governance and ethics. Conversely, a negative correlation was observed between CP Efficiency and CP Impact ($\rho = -0.192$), suggesting that perceptions of increased efficiency might inversely relate to the perceived overall impact of CP, implying that while CP may boost operational efficiency, their broader impact on mental health care outcomes may not be perceived as positively. Additionally, a minor negative correlation was noted between Governance and Ethical Frameworks and CP impact ($\rho = -0.090$), indicating a subtle link where higher governance and ethical standards slightly correlate with lower perceived CP impact.

Expanding on Chi-square analyses, associations between categorical variables such as Role and CP Benefit, and Role and Integration Challenge were examined to discern significant trends in perceived benefits and challenges. The Chi-square test exploring the association between Integration Challenge and Role, with a statistic of approximately 16.21 and a p-value of 0.578 across 18 degrees of freedom, suggested no statistically significant association between integration challenges and respondents' roles, indicating uniform concern distribution across different professional roles. Similarly, the analysis between Role and CP Benefit yielded a statistic of 11.86 with a p-value of 0.8544, demonstrating consistent perceptions of CP benefits across various professional roles. The Gender and CP Benefit association, showing a statistic of 1.56 with a p-value of 0.955, further confirmed that perceptions of CP benefits remain consistent across genders.

The following figure (see Fig. 5) quantifies the accuracy of predictions concerning the benefits derived from CP in healthcare, grouped into various benefit categories: Improved Patient Engagement, Enhanced Interprofessional Collaboration, Better Treatment Personalization, and Increased Accessibility to Services. Each category is bifurcated into counts of true (accurate) and false (inaccurate) predictions, offering an evaluative perspective on the predictive model's performance. A conspicuous observation is the substantial number of accurate predictions within the 'Improved Patient Engagement' category, dwarfing the counts of correct predictions in other categories. This suggests that the model is particularly adept at recognizing factors or attributes that lead to better patient engagement outcomes associated with CP use. In contrast, the categories of 'Enhanced Interprofessional Collaboration,' 'Better Treatment Personalization,' and 'Increased Accessibility to Services' exhibit significantly fewer correct predictions, with the latter two categories showing a parity between accurate and inaccurate predictions. This could

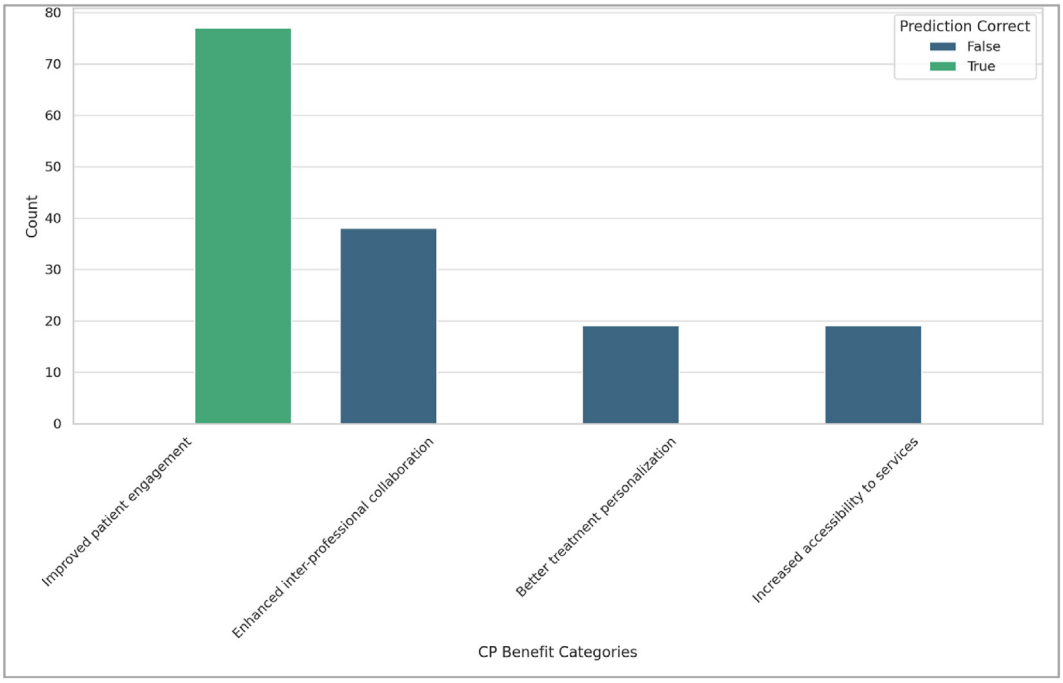

Fig. 5. Accuracy of CP benefit predictions.

imply a nuanced complexity within these benefits that the model fails to capture, or it may reflect a balanced distribution of factors influencing these outcomes, rendering the predictive model less effective. The graph provides critical insights for HCPs and policymakers into which CP benefit areas are well understood and predicted by current models, and which require further research and model refinement. The disparity in predictive accuracy across categories underscores the need for more sophisticated or tailored modelling approaches to better forecast a wider spectrum of CP-related benefits in the healthcare context.

In examining differences across groups for continuous variables such as Governance and Ethical Frameworks, ANOVA was employed for comparisons across multiple groups (e.g., different roles or years of experience), and independent t-tests were used for two-group comparisons as necessary. ANOVA testing on Governance and Ethical Frameworks ratings across different Roles yielded no statistically significant differences ($p = 0.314$), indicating uniform perceptions of governance and ethical frameworks across various professional roles. An additional ANOVA test assessed perceptions across different Age groups, also revealing no statistically significant differences ($p = 0.365$), suggesting consistent governance and ethical standards views across age groups within the dataset.

Thematic analysis of comments aimed to extract common themes and insights from respondents' feedback, focusing on user experience, platform integration with existing systems, privacy and security concerns, and the effectiveness of CP in impacting patient care and treatment outcomes.

5. Discussions

5.1. Discussion topics

PL and CP are lauded for enhancing efficiency and governance, yet their direct influence on healthcare outcomes and collaborative efforts is intricate, marked by a discernible less positive correlation between CP efficiency and their overall impact. This contrast underlines the significance of establishing strong governance and ethical frameworks to effectively harness PL and CP in healthcare contexts. Key findings from the analysis illuminate the integration of PL and CP in mental health care and the pharmaceutical industry. Initially, HCPs exhibit an optimistic view of PL and CP, recognizing their capacity to boost efficiency and governance. Nevertheless, this positive perception does not convincingly extend to their impact on mental healthcare outcomes, as indicated by the negative correlation between CP efficiency and overall impact. Furthermore, the consistency in perceptions across various professional roles and age groups reveals a collective agreement on PL and CP advantages and challenges, alongside governance and ethical principles. This consensus suggests that, despite varied backgrounds, healthcare workers share similar perspectives on incorporating these technologies. The absence of marked perceptual differences based on demographic factors underscores the necessity to universally address concerns and capitalize on the recognized benefits. The common challenges, particularly regarding CP integration, underscore the need for industry-wide strategies to manage the complexities PL and CP introduce.

These insights might offer a refined comprehension of how PL and CP are transforming the pharmaceutical manufacturing and mental healthcare sectors. While the benefits of efficiency and potential for innovation are acknowledged, integrating these technologies poses challenges that necessitate cautious management, especially concerning governance and ethics. The research highlights the paramount importance of comprehensive governance and ethical frameworks to enhance PL and CP benefits and address their integration challenges in healthcare. The statistical analysis demonstrated a slight positive correlation between the efficiency of CP and ratings for Governance and Ethical Frameworks, suggesting HCPs acknowledge that efficient CP are likely to support strong governance and ethical standards. Conversely, the non-clear correlation between CP efficiency and CP impact raises questions about the gap between operational efficiency and its perceived effect. This discrepancy may echo the literature's distinction between “efficiency” in procedural terms and “effectiveness” in outcomes, pointing to the possibility that while CP may optimize processes, their direct contribution to enhancing mental health outcomes remains ambiguous.

The following chart (see Fig. 6) offers a visual summary of ‘CP Impact’ scores across various ‘CP Benefit’ categories, which were presumably evaluated by HCPs. The categories presented are ‘Improved Patient Engagement’, ‘Enhanced Interprofessional Collaboration’, ‘Better Treatment Personalization’, and ‘Increased Accessibility to Services'. Each bar

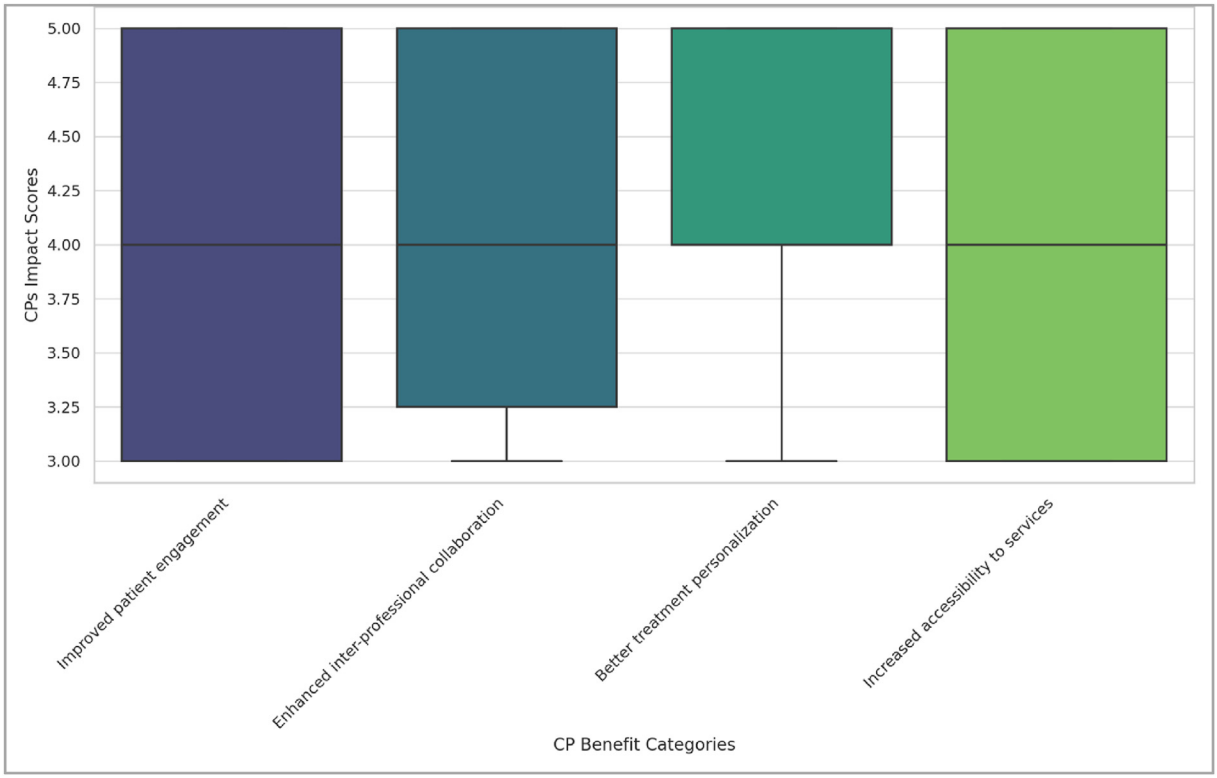

Fig. 6. Distribution of 'CP Impact' scores by 'CP Benefit' categories.

represents the mean impact score attributed to each benefit category, providing a comparative assessment of the perceived effectiveness of CP in achieving these benefits. A higher score suggests a more substantial perceived impact of CP within that category. The 'Increased Accessibility to Services' benefit category showcases the highest mean impact score, indicating that CP are seen as most effective in enhancing service accessibility. In comparison, 'Improved Patient Engagement', while still positively rated, shows a marginally lower impact score than the others. The relatively uniform scores across the categories, with a narrow range from around 4.5 to 5, suggest that CP are generally perceived as beneficial, with only slight variations in impact across different areas of benefit. The homogeneity of the impact scores reflects a consensus on the value of CP in healthcare settings, with the variance among categories providing nuanced insights into where CP are perceived to excel.

The consistency in perceived advantages and challenges across professional roles, as shown by the ANOVA and chi-square tests, reflects a literature-reported uniform acknowledgment of AI's potential and obstacles across healthcare professions. It indicates a collective understanding of the transformative potential of these technologies, alongside mutual concerns about their clinical integration. The research aligns with the general optimism found in literature about PL and CP potential to innovate healthcare practices. Yet, it also echoes warnings against overvaluing short-term impacts while underestimating long-term changes. The observed correlations between CP efficiency and CP impact might suggest that immediate operational improvements do not directly translate to short-term enhancements in healthcare outcomes, but leave future research directions.

The minimal difference indicated by Cohen's d in the context of PL Impact underscores the possibility that other, unexplored factors might significantly influence PL Impact assessments. Literature on the complexity of evaluating PL's impact on healthcare suggests a multidimensional influence on practice changes and policy enforcement. The study's results fulfill the research objectives in some of the most pressing areas, recognizing the benefits of efficiency and governance while uncovering a complicated relationship with perceived impacts. The findings on common perceptions of advantages and challenges, along with a consensus on governance and ethical frameworks, indicate a uniform viewpoint among HCPs, underscoring the importance of these discussions in the current dialogue. However, the minor to negligible effect sizes and correlations hint at the necessity for future research to consider other factors, such as patient outcomes, cost, accessibility, and broader socio-technical aspects, to fully apprehend and exploit PL and CPs' transformative capacity in healthcare.

5.2. *Observations from collected comments and open questions*

From a practical standpoint and considering the perspective of a mental health patient leveraging CP for treatments and post-hospital admission, these impacts can be multifaceted.

1. Enhancing Patient Privacy and Data Protection: PL, such as GDPR in the European Union, establishes strict guidelines for the handling of personal data. For mental health patients, this means that CP must ensure the confidentiality and security of their health information, especially when it involves sensitive data related to psychiatric treatments. These platforms must implement robust encryption, access controls, and data protection measures to comply with these laws, thereby safeguarding patient information from unauthorized access or breaches.
2. Consent and Transparency in Data Usage: PL mandates that patients must be fully informed about how their data is used and must consent to these uses explicitly. In practical terms, this means that before a mental health patient engages with a CP, they should receive clear information about what data is collected, how it is used, for what purposes, and with whom it is shared. This transparency empowers patients to make informed decisions about their participation in digital health platforms and treatments.
3. Impact on Cross-Border Data Sharing: For mental health patients participating in treatments that involve CP operated by pharmaceutical manufacturers, PL impact how data can be shared across borders.

This is particularly relevant when the manufacturers or digital platforms are based in different countries with varying privacy regulations. The GDPR requires that patient data is only transferred to countries or entities that provide an adequate level of data protection, thereby affecting how globally distributed treatment and research programs can be conducted. This issue is particularly significant, notably within the United States and China. In Europe, there is a tendency to eschew services hosted in the U.S., attributed to concerns regarding data protection. The U.S., recognized for its robust innovation in the technology sector, frequently introduces novel and groundbreaking services. However, the inadequate data protection measures in place deter Europeans from utilizing these potentially efficient services. This represents a substantial problem and challenge, especially about consumer protections. Consequently, this scenario compels European nations to foster innovation independently, a process that inherently requires time.

4. Implications for Treatment Personalization and Innovation: While PL impose certain restrictions, they also pave the way for more personalized and innovative treatments. By ensuring that patient data is handled securely and ethically, these laws build trust in digital health platforms. Trust encourages more patients to participate in digital health initiatives, providing a richer data pool from which AI and analytics can derive insights. This, in turn, can lead to more effective, personalized treatment plans and post-hospitalization care strategies.

From the perspective of a mental health patient leveraging CP, PL can play a critical role in ensuring their data is protected, used transparently, and handled ethically. While these regulations may pose challenges to the deployment and operation of CP, they also offer a framework that promotes patient trust and confidence in digital health solutions. By adhering to PL, CP can enhance the treatments and post-admission care of mental health patients, ensuring that innovations in healthcare technology translate into tangible benefits for patients while safeguarding their privacy and rights.

Leveraging CP in the context of medium to long hospital stays for mental health patients opens up a myriad of practical use cases that can enhance treatment efficacy, patient experience, and continuity of care. PL will play a crucial role in ensuring the ethical handling and protection of patient data throughout these processes. The following points will present some future-oriented practical use cases for CP solutions in mental health care:

- Real-time Monitoring and Personalized Treatment: Wearable devices can monitor patients' biomarkers, mood, and vital signs in real time, providing continuous data streams to CP. This data can be analyzed to tailor treatment plans to the individual's specific needs, adjusting medications and therapies based on objective indicators of stress, anxiety, or other symptoms. PL ensure that this sensitive information is collected, stored, and processed securely, respecting patient consent and confidentiality.
- Seamless Coordination of Care: For patients undergoing treatment from multiple specialists, CP can serve as a centralized platform for sharing patient information, treatment plans, and progress updates. This ensures that all care providers are informed and aligned, leading to more coordinated and effective care. PL are relevant in safeguarding patient information as its shared across different healthcare providers within the platform.
- Supply Chain Management for Medications: From a B2B digital manufacturing perspective, CP can streamline the supply chain of psychiatric medications, ensuring timely delivery of the right drugs in the right dosages during and after a patient's hospital stay. By integrating supply chain data with patient treatment plans and progress, CP can anticipate medication needs and manage inventory accordingly. PL play a role in protecting patient-related data that may be used in forecasting and supply chain planning.
- Post-discharge monitoring and Support: After hospital discharge, wearable devices and IoT can continue to monitor patient health indicators, sending data to CP for analysis. Healthcare providers can use this data to offer ongoing support, identify potential relapses early, and adjust outpatient treatment plans as needed. PL are critical to ensuring that data collected post-discharge is treated with the same level of confidentiality and security as during the hospital stay.
- Research and Development: Data collected through CP can contribute to research on mental health treatments, helping pharmaceutical companies and healthcare providers understand the effectiveness of drugs and therapies, patient adherence, and long-term outcomes. PL ensure that patient data used for research is anonymized and handled according to ethical research standards.

Leveraging CP solutions in mental health care presents opportunities to revolutionize treatment approaches, patient monitoring, and care coordination, with an emphasis on personalized and data-driven care. The integration of wearable devices could expand these possibilities further into the realm of continuous, real-time health monitoring. Throughout all these use cases, adherence to PL ensures that patient data is handled securely, ethically, and with respect for patient autonomy, building trust in digital health solutions and safeguarding the well-being of mental health patients.

PL, such as the EU GDPR, set stringent guidelines for the collection, storage, and use of personal data, offering a robust framework to protect the rights and freedoms of individuals. For mental health patients, whose data usually includes highly sensitive information, these protections are not just legal formalities but essential shields against potential misuse and stigmatization.

1. Contextualizing the Importance of PL for Mental Health Patients: Confidentiality and Trust: In the realm of mental health care, the confidentiality of patient information is fundamental to establishing and maintaining trust between patients and healthcare providers. PL can ensure that patients' information is treated with the utmost discretion, fostering a safe environment for individuals to seek and receive help.
2. Autonomy and Control: These laws empower patients by granting them control over their information. Rights such as access to personal data, the ability to correct inaccuracies, and the option to consent to or refuse specific uses of their data are crucial for patients' autonomy. For individuals navigating the complexities of mental health issues, such control can contribute significantly to their sense of agency and dignity.
3. Preventing Discrimination and Stigmatization: By restricting unwarranted access to and dissemination of personal data, PL play a crucial role in preventing discrimination and stigmatization based on mental health status. This is especially vital in contexts like employment and insurance, where misuse of mental health information could have detrimental effects on patients' lives.
4. Security Measures Against Breaches: The implementation of stringent security measures mandated by PL helps protect mental health data from breaches and cyber-attacks. Given the potentially devastating consequences of such breaches, the laws ensure that organizations adopt preventive strategies, thus safeguarding patients' information from unauthorized access.
5. Enabling Technology with Safeguards: As mental health services increasingly leverage digital platforms for treatment and support, PL ensure that these technological advancements do not come at the cost of patients' privacy. By setting standards for data protection, the laws facilitate the integration of technology in healthcare, ensuring that

innovations like CP enhance patient care while maintaining strict privacy safeguards.

6. Legal Recourse and Accountability: PL provide a mechanism for accountability, offering patients legal recourse in the event of privacy violations. This aspect could be crucial for mental health patients, who may be particularly vulnerable to the effects of such violations. The prospect of enforcement and penalties serves as a deterrent against careless or unethical handling of patient data.

The focused follow-ups on the questionnaire responses highlighted some relevant intersections of PL and mental health care. These laws are not merely regulatory hurdles but foundational elements that ensure mental health services are provided in a manner that respects individuals' privacy, dignity, and rights. As digital platforms become increasingly integral to healthcare delivery, the importance of robust privacy protections cannot be overstated. Protecting mental health patients in this digital era requires a concerted effort to uphold these laws, ensuring that the march of technological progress does not outpace our commitment to privacy and ethical care.

5.3. Implications of the findings and significance

The results of the statistical analyses offer several insights into the domains of mental health care services and pharmaceutical manufacturing, particularly in the realm of PL and CP. The observed mild positive correlation between the efficiency of CP and the adequacy of Governance and Ethical Frameworks suggests possible increase in the perceived efficiency of community platforms is associated with an enhancement in the perceived robustness of governance and ethical standards. This indicates that CP perceived as efficient may also be viewed as more likely to comply with or promote the establishment of strong governance structures. However, the minimal effect size (Cohen's d) implies that the variance in efficiency perceptions among different groups is slight, hinting that while the difference is statistically significant, its practical effect on everyday operations may be minimal. Role of Professional Background: The absence of notable differences in governance and ethical framework perceptions across various professional roles, as shown by the ANOVA results ($p = 0.314$), counters the idea that professional background significantly influences views on governance and ethics in the adoption of PL and CP. This consistency across professional demographics underscores a potentially collective viewpoint or similar exposure to training and policies regarding PL and CP, potentially facilitating the adoption of these technologies across healthcare sectors. Additionally, some of the outcomes revealed no significant relationship between professional roles and the perceived benefits or challenges of integrating CP, indicating these views are common and not confined to specific roles. This widespread perception could simplify the development and execution of policies, as the concerns and advantages are consistent among HCPs.

The notably small effect sizes, as indicated by Cohen's d for 'PL-Impact' and the eta-squared value for ANOVA, suggest that although statistical correlations and differences were identified, their real-world significance is restrained. This underscores the necessity for further investigation into what drives meaningful changes in perceptions and practices in the healthcare sector. The findings, characterized by weak associations and small effect sizes, caution against relying solely on statistical data to gauge the impact of PL and CP. It emphasizes the need to combine quantitative results with qualitative insights to fully understand the implications for policy and practice. Moreover, the results advocate for more focused research to unravel the complex effects of PL and CP on healthcare, including their influence on patient outcomes, staff workflows, and inter-professional collaborations.

While the correlations identified in this study provide valuable insights into the relationships between variables such as CP efficiency, perceived impact, and governance frameworks, it is crucial to recognize the limitations inherent in correlational analysis. Correlation does not imply causation; it merely indicates a statistical association between variables. For instance, while a positive correlation between CP efficiency and governance and ethical frameworks suggests that as perceptions of efficiency increase, so do perceptions of robust governance, this does not establish that improvements in governance cause an increase in efficiency. The observed correlations could be influenced by other unmeasured variables or confounding factors, such as organizational culture, the level of technological literacy among HCPs, or external regulatory pressures.

To explore causality, further research would require experimental or longitudinal study designs that can track changes over time and establish temporal sequences. For example, a longitudinal study could monitor the introduction of specific governance frameworks and measure subsequent changes in CP efficiency and impact over time. Alternatively, experimental designs could manipulate variables like governance practices and observe resultant changes in CP efficiency, thereby providing stronger evidence for causal relationships. The statistical significance of the correlations was assessed using p-values derived from Pearson's correlation tests. In this context, a p-value indicates the probability that the observed correlation occurred by chance under the null hypothesis of no relationship. Typically, a p-value of less than 0.05 is considered statistically significant, suggesting that there is less than a 5% probability that the observed correlation is due to random chance.

The reported correlations had varying degrees of statistical significance. For instance, the correlation between CP efficiency and governance frameworks might have been statistically significant with a p-value less than 0.05, indicating a likely genuine association. However, correlations with higher p-values, such as those approaching or exceeding 0.05, suggest a weaker and potentially spurious relationship. It is essential to interpret these results cautiously, as statistical significance alone does not confirm a meaningful or practically significant relationship, especially when the effect size and strength of the correlation is small.

While the findings provide a basis for understanding the interplay between CP, PL, and governance in healthcare, they do not establish causal pathways. The observed correlations highlight potential areas of interest that warrant further exploration through more rigorous study designs capable of elucidating causal mechanisms. This limitation should be acknowledged, and future research directions should aim to build on these preliminary findings with more robust methodologies.

5.4. Contributions to the literature and future research directions

The research aimed to contribute to the discussions on the need for sound governance and ethical use of digital platforms, emphasizing continuous evaluation as these technologies advance. The results suggest avenues for future investigation to further clarify the practical integration of PL and CP within healthcare settings. It is evident that beyond statistical analysis, the tangible implications and experiences of HCPs provide a crucial perspective for assessing the success of technology integration. This might include conducting longitudinal research, qualitative interviews, and participatory action research to ensure that the insights of those affected by these technologies inform and guide their implementation. These findings offer an initial comprehension of PL and CP role in healthcare, underlining the convergence of technology, governance, and clinical practice. They bridge empirical research and practical application, advocating for a comprehensive approach to technology integration that values both statistical and practical significance. This research emphasizes the necessity for more in-depth longitudinal and qualitative studies, aligning with literature that calls for thorough evaluations of CP's enduring effects on healthcare practices. As CP evolve, this study underscores the complex nature of technology integration into healthcare, highlighting the importance of managing expectations and the adoption process carefully.

While providing important insights, this study acknowledges some limitations. The small effect sizes suggest that the identified statistical relationships may have limited practical relevance, prompting questions about the findings' applicability in real-world settings. The cross-sectional design limits causal inference or the tracking of changes over time, and the sample might not fully represent the diverse healthcare professional population, potentially impacting the generalizability of the findings. Moreover, the study primarily reflects HCPs' views and may not capture the interdisciplinary impacts fully, including patient, IT professional, and administrative staff perspectives. Future research directions include applying technology adoption models to PL and CP, assessing their cost-effectiveness, and addressing the study's limitations to provide clearer conclusions and practical recommendations for PL and CP integration into healthcare.

6. Conclusions

This research undertook an examination of the effects of PL and Digital B2B Manufacturing Platforms, specifically CP, on efficiency, collaboration, and innovation in the pharmaceutical manufacturing and mental health care fields. Utilizing both quantitative and qualitative methods, the study aimed to capture HCP' detailed perceptions of PL and CP integration, along with the governance and ethical frameworks that support these technological innovations. Statistical analysis indicated slight positive correlations between CPs' perceived efficiency and the strength of governance and ethical frameworks, although the small effect sizes moderate these findings' practical significance. The absence of notable differences among various professional roles points to an emerging agreement or standardization in HCPs' views on these technologies. Furthermore, the consistent recognition of the benefits and challenges of integrating PL and CP highlights common experiences among professionals throughout the healthcare sector. While the statistical significance supports the relationships identified, the actual effectiveness of these technologies in practice may vary from the data's implications. As the integration of PL and CP into healthcare continues, it's evident that this process involves ongoing learning and adaptation. The sector must stay flexible, embracing technological evolution and considering feedback from all stakeholders. Future research should explore more diverse methodologies, including longitudinal and qualitative studies, broader sampling strategies, and various viewpoints to develop a holistic, evidence-based perspective on PL and CP in healthcare.

This study underscores both the advantages and complexities of technological integration in the mental health space. Standing at the juncture of innovation and established practices, it's imperative to proceed with an informed, critical, and open-minded strategy, ensuring PL and CP implementation bolsters healthcare delivery while upholding ethical standards and patient-centered care.

CRediT authorship contribution statement

Antonio Pesqueira: Writing – review & editing, Writing – original draft, Validation, Supervision, Project administration. **Andreia de Bem Machado:** Methodology, Investigation, Formal analysis. **Sama Bolog:** Methodology, Investigation, Formal analysis. **Catarina Costa:** Validation, Supervision, Resources.

Data availability statement

The authors are prepared to provide the data employed in the analysis presented, as well as the components of the entire methodology process.

Declaration of competing interest

The authors affirm that they possess no financial conflicts of interest that could potentially affect the impartiality of this research. Furthermore, there were no instances of financial support, sponsorship, or any relationships perceived as constituting a conflict of interest concerning the work documented in this manuscript.

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