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ORIGINAL RESEARCH ARTICLE

Digital Literacy, Digital Readiness and Acceptability of Digital Mental Health Among Mental Health Professionals: Findings from the Italian DIGIT-PSY Study

Laura Orsolini[1] · Giulio Longo[1] · Mario Luciano[2] · Gaia Sampogna[2] · Andrea Amerio[3,4] · Anna-Rita Atti[5] · Stefano Barlati[6] · Giuseppe Blasi[7] · Paola Calò[8] · Claudia Carmassi[9] · Giuseppe Carrà[10] · Giovanni Castellini[11] · Armando D'Agostino[12] · Pasquale De Fazio[13] · Chiara De Panfilis[14] · Giorgio Di Lorenzo[15] · Matteo Di Vincenzo[2] · Carla Gramaglia[16,17] · Valeria Latorre[18] · Mirko Manchia[19] · Giovanni Martinotti[20] · Mauro Pettorruso[20] · Federica Pinna[19] · Gabriele Sani[21,22] · Gianluca Serafini[3,4] · Maria Salvina Signorelli[23] · Sarah Tosato[24] · Antonio Ventriglio[25] · Umberto Volpe[1]

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Abstract
Beyond specific training in Digital Mental Health (DMH)/Digital Psychiatry (DP), mental health professionals (MHp) should own basic digital abilities and competences and a general openness to integrating technology into both clinical practice and daily life. These digital drivers have not been adequately investigated among MHp in Italy. As part of the DIGIT-PSY project, a multicenter observational study was conducted using the EUSurvey® platform. From May to September 2023, a cohort of multiprofessional MHp from 27 Italian university centers was surveyed to assess digital literacy (DHL), readiness (TR) and acceptability (ATiPP). The main aim was identifying whether these digitally-derived variables could influence the level of digitalization proneness in MH care. Overall, 60% of our sample was technologically ready, with a moderate-high level of basic DHL. Two TR factors are mainly represented among Italian MHp: optimism and discomfort. Multivariate linear regression revealed that higher ATIPP ($p<0.001$), higher DHL ($p<0.001$), higher perceived feasibility in digital implementation ($p<0.001$) and higher levels of social influence ($p=0.006$) were positive drivers in digitalization by increasing TR [$(F(12,1354)=38.743$; $R^2=0.256$; $p<0.001$]. Conversely, a lower satisfaction derived by previous DMH/DP experiences was the most significant negative factor ($p=0.037$). Interestingly, Italian MHp overly displayed a higher optimistic view, despite higher discomfort perceptions from technology and digital innovation. However, Italian infrastructures and services and the lack of national regulatory guidelines in DMH/DP, together with an overly low level of education and training since University courses, may inhibit the digitalization process. Targeted interventions should consider national and university-based initiatives to overcome this gap.

Keywords Digital literacy · Digital mental health · Digital psychiatry · Digital readiness · Mental health professionals · Psychiatry

Introduction

The COVID-19 pandemic revealed the poor level of digitalization within mental health services worldwide, by pointing out the need to implement initiatives and country-based processes involving all mental health infrastructures and services at any stages (preventive, treatment, rehabilitation) and settings (private vs public, outpatient vs inpatient services) to accelerate the capillary integration of digital solutions in mental health and care (Hamlin et al., 2022; Husain et al., 2021). Indeed, despite the digital development in mental healthcare rapidly changed over the last decades, also thanks to the COVID-19 outbreak which accelerated the process, also in those countries where digital mental health (DMH) were

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unavailable (Carter et al., 2021; Murphy et al., 2024), there is still the urge to specifically improve mental health professionals' skills and competences in prescribing and providing DMH and Digital Psychiatry (DP) interventions in routine clinical practice (Jackson et al., 2024; Lopez-Castroman et al., 2024; Pote et al., 2021). Previous studies suggested how the education and training in DMH/DP and the presence of a formal academic curriculum should be the cornerstone of the digitalization process among mental health professionals (Hilty et al., 2015; Orsolini et al., 2021, 2022, 2025a; Volpe et al., 2024). Indeed, beyond the technical and knowledge component of being specifically trained and educated in DMH/DP, mental health professionals should much more likely own a set of basic digital abilities and competences (i.e., digital literacy) as well displaying a digital propensity (i.e. digital readiness) and acceptability to/for technology and digital solutions in their daily personal and professional lives.

Indeed, before implementing education and training in DMH/DP, there is still the need to evaluate whether there are gaps in digital literacy and consequently the professional's digital use between personal and professional life which may represent an inhibitor factor of digital implementation. Similarly, one could argue that mental health professionals' digital readiness and, hence, acceptability of digital tools also in professional life and clinical practice could also represent determinants of the digital process in mental health care. Digital health literacy (DHL, e.g. "eHealth literacy") comprises all skills which allow individuals to search, select, appraise and apply online health information and health care-related digital applications in daily life (Norman & Skinner, 2006). DHL indicates "*the degree to which individuals own the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions*" (Ratzan and Parker, 2000). The technology readiness (TR) construct refers to individuals' propensity to embrace and use new technologies for accomplishing goals in personal and professional life (Parasuraman, 2000). This dimension can be considered an overall mindset resulting from a gestalt of mental motivators/enablers (i.e. optimism and innovativeness) and inhibitors (i.e., discomfort and insecurity) that collectively determine an individual's predisposition to use new technologies and digital solutions in different contexts, including professional life (Caison et al., 2008; MacNevin et al., 2021). The digital acceptability could be potentially influenced by digital literacy and/or technology readiness, by raising some doubts regarding the need to target both digital literacy and/or readiness in a roadmap to be developed in facilitating the implementation process of digitalization in mental health care. However, despite the above-mentioned determinants having been explored in other medical and non medical fields, they have not been adequately investigated among Italian mental health professionals. Hence, one could argue that they could potentially act as influencing factors of the digitalization process of mental health services, particularly referring to the individual component of mental healthcare providers.

Within the DIGIT-PSY research project, a set of digitally-driven determinants were investigated to evaluate which factors could significantly influence the greater or lesser propensity to the digitalization process among all mental health professionals in Italy. In fact, despite the COVID-19 pandemic significantly accelerating the digitalization process in mental health care (Di Carlo et al., 2021; Trabucco et al., 2021; Sheriff et al., 2023), there are still significant gaps in the permanent implementation of digital tools and technologies in mental health care settings in Italy in the post-COVID area (Orsolini et al., 2025b). One could argue that this gap could be due to factors specifically related to the environment (i.e., technology equipment, lack of financial resources, etc.) and/or related to mental health professionals' attitudes, proneness and skills (i.e., lack of education/training in DMH/DP, lack of technology readiness, lack of digital literacy, poor level of acceptability of digital revolution/digitalization process of mental health care, and so forth). Indeed, at the time of present writing, there are no published studies specifically investigating which internal negative/positive determinants of Italian mental health professionals could be drivers/inhibitors of the digitalization process of mental health care in Italy.

Therefore, the primary objective of the present study was to provide, in a representative sample of Italian mental health professionals, the current state-of-the-art regarding: a) their level of digital literacy (i.e., basic and advanced digital competence and knowledge); b) their level of digital readiness (e.g., propensity to the digitalization process in mental health and care); and, c) their level of acceptability of digital innovation in mental health and care as well as assessing whether social influence could be another potential factor influencing the mental health professionals' proneness to accept the mental health care digitalization. These variables were investigated and compared by stratifying a multiprofessional sample of Italian mental health providers according to the type of professional category, the level of clinical experience, the age and other socio-demographic features, as well as the level of knowledge/training received in the field of DMH/DP. Our research hypothesis was to find sex- and generation-based differences across these indices, by hypothesing that younger mental health professionals display higher levels of digital literacy and readiness and, hence, a higher acceptability of the digitalization process in mental health care. While older mental health professionals may be more influenced by social influence index in their proneness to accept the digital process, i.e. working in a setting with colleagues who know and practice DMH/DP and/or who accept DMH/DP as alternative and/or complimentary modality. Secondary outcomes included assessing whether the level of digital acceptability,

digital literacy, digital readiness and social influence could represent positive and/or negative drivers of a greater and/or a lesser propensity to the DMH/DP implementation within Italian mental health services. Our hypothesis was to confirm that the lack of digital literacy may significantly influence the process rather than other determinants. The final goal was to clearly select which internal determinants should be targeted for building a roadmap on political, financial, policy, institutional and academic strategies, useful as starting and consolidating points in DMH/DP implementation in Italy.

Methods

Study Design and Sample Recruitment Strategy

Within the DIGIT-PSY research project, an Italian multicentric observational study disseminated through the European platform EUSurvey® to a cohort of multiprofessional mental health providers, recruited from 27 Italian University collaborating centers from May 1st, 2023 to September 30th, 2023, a set of digitally-delivered individual determinants (including digital literacy and digital readiness) were investigated to evaluate whether they could influence the level of digitalization proneness of professionals in mental health and care. The study enrolled Italian mental health professionals, including M.D. specialized in psychiatry, psychiatry trainees, psychologists (with or without a psychotherapy training), and professionals working in psychiatric rehabilitation (including technicians in psychiatric rehabilitation [PRT] and professional educators working in mental health [PE]). Participation was voluntary and only processed once a written informed consent was obtained. No financial incentive was provided to participants. All PI of each coordinating center was actively involved in recruiting a representative sample of mental health professionals, according to the established inclusion and exclusion criteria. The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki and according to the guidelines for Good Clinical Practice (GCP) (WHO, 2013) and according to the CHERRIES guidelines (Eysenbach, 2004, following the approval by the Ethical Committee of the Marche Region (protocol code DIGIT-PSY n. 62/2023).

The Structure of the Survey

The questionnaire is constituted by 6 sections (Supplementary File 1). The questionnaire took around 20–25 min to be completed. The first section included socio-demographic and professional/job variables. The second section explored the level of digitalization of mental health professionals, including the pre- and post-COVID-19 clinical experience in delivering DP/DMH interventions in their clinical practice, the degree of knowledge, expertise, education and training on DMH/DP, including the degree of expertise and knowledge by their colleagues. The second section was developed through the consultation of studies by Dorés et al. (2020) and Sander et al. (2022), in order to create a variable indicative of the Digitalization index (named 'DIGi index') composed by items 2, 4, 5 and 6 of the second section. All mental health services were stratified in three groups: a) low level of digitalization (DIGi ranged 4–9); b) moderate level of digitalization (DIGi ranged 10–15); c) high level of digitalization (DIGi ranged 16–20).

The third section referred to the level of Digital Literacy of mental health professionals, e.g. the level of digital competence and knowledge in the technological/digital field ("what") and the ability to use different technological/digital tools ("how"). The third section is constituted by 21 items on a 4-point Likert scale (from "*1=extremely easy*" to "*4=extremely difficult*") developed and adapted from the Digital Health Literacy Instrument (DHLI) by van der Vaart and Drossaert (2017) which displayed a satisfactory Cronbach alpha of 0.87 (confirmed also in our study, $\alpha=0.868$). The third section includes an overall Digital Health Literacy (DHL) total score (sum of all 21 reversed items) and the following 7 subscales: 1) operational skills, i.e. the ability to use the computer and Internet browser (items 1–3)(DHL-OS); 2) information searching skills, i.e. the ability to use correct search strategies (items 4–6)(DHL-IS); 3) evaluating reliability of online information skills (items 7–9), in general (DHL-ER); 4) the ability to determining relevance of the information to oneself in a particular situation (items 10–12)(DHL-DR); 5) navigation skills, i.e. the ability to navigate and orientate on the Web (items 13–15)(DHL-NS); 6) ability to add self-generated online contents (items 16–18)(DHL-AC); 7) skills regarding protecting and respecting privacy while using the Internet (items 19–21)(DHL-PP). Subjects are asked to score how difficult they perceive certain tasks to be and how often they experienced certain problems on the Internet. Each item was scored on a 4-point scale, with response options ranging from "very easy" to "very difficult" and from "never" to "often". All scores were reversed. Hence, a higher score indicates a higher level of DHL.

The fourth section comprises two adapted questionnaires: the Attitudes towards Telemedicine in Psychiatry and Psychotherapy (ATiPP) adapted to DP/DMH interventions (Tonn et al., 2017) and the 2-items questionnaire on Social Influence derived from the study by Sander et al. (2022). The ATiPP is an 8-item on a 5-point Likert scale assessing the clinician's attitude towards the use of DMH/DP in their clinical practice. The ATiPP provides an overall total scale [ATiPP_total_score] obtained by summing all items of the scale and an index [ATiPP_index] obtained by divided the overall total score into 8 items, ranging from 1 to 5, with higher values indicating a

more positive attitude/acceptability towards DMH/DP (Sander et al., 2022; Schulze et al., 2019; Tonn et al., 2017). The ATiPP questionnaire was originally designed to assess attitudes towards telemedicine in psychiatry and psychotherapy, by showing a good reliability (Cronbach's alpha = 0.73) (Sander et al., 2022). In our study Cronbach's α was 0.893. The 2-items Social Influence scale (SI) assesses on a 5-point scale how the social desirability could predict the clinician' behavioral intentionality and propensity in delivering DMH/DP interventions to patients (Venkatesh et al., 2003; Sander et al., 2022).

The fifth section is constituted by the Technology Readiness Scale 2.0. (TRI 2.0.) (Parasuraman, 2000; Parasuraman & Colby, 2014; Hunkin et al., 2020), a 16-items on a 5-point Likert scale questionnaire assessing the level of 'technology readiness' (i.e., the clinician's propensity to use new technologies in their own personal and/or professional life). The questionnaire has been developed by the longer original 36-items TRI 1.0. version by Parasuraman (2000) and adapted by Caison et al. (2008) for health care settings, by changing the wording of some items to focus on the general healthcare setting rather than a consumer setting. The TRI 2.0. is composed by an overall total score (TR) and 4 subscales: a) the motivator OPT (optimism) assessing the positive attitude towards technology and the belief that technology could increase/improve the individual's control, management, flexibility and efficiency in different life settings (items 1–4)[TR-OPT]; b) the motivator INN (innovation) assessing the tendency to be/become a pioneer in the field of technology (items 5–8)[TR-INN]; c) the inhibitor DIS (discomfort) assessing the perceived lack of control induced by the advent of technology and the sensation to become overcomed by the technology progress (reversed items 9–12)[TR-DIS]; d) the inhibitor INS (insecurity) assessing the level of uncertainty and skepticism towards the potential benefits derived by the advent of the technology and the worries about the potential detrimental consequences derived by the harmful and risky use of technological tools (reversed items 13–16)[TR-INS]. The mean TR score is calculated by subtracting the technology readiness "inhibitor" variables (OPT and INS) from the TR "contributor" variables (OPT and INN) (Parasuraman, 2000; Caison et al., 2008). A positive TR score indicated "technology ready" while a negative TR score indicated "non-technology ready" mental health professionals (MacNevin et al., 2021). TR reflects the subject's attitude and inclination towards technology and not the subject's aptitude or his/her technology skills (Parasuraman, 2000; Parasuraman & Colby, 2014). The TRI 2.0. scale also allows to stratify mental health professionals in five categories, based on the different combination of the abovementioned subscales: 1) explorers (high motivation, low inhibition); 2) pioneers (high motivation, high inhibition); 3) skeptics (low motivation, low inhibition); 4) paranoids (moderate motivation, high inhibition); 5) latecomers/hesitant (low motivation, high inhibition).

In the current paper, it has been specifically carried out an analysis evaluating the levels of digital literacy (as assessed in the third section of questionnaire), digital acceptability and social influence (fourth section) and the digital readiness (fifth section), by investigating also if there was any relationship with the DIGi index (second section), as assessed among a multiprofessional cohort of mental health providers, with the aim to explore whether these digitally-delivered determinants could influence the digitalization process of mental health services in Italy.

Statistical Analyses

Statistical analyses were carried out by using the *Software Statistical Package for Social Sciences* (SPSS) for *MacOS* (version 26.0, IBM Corp., Armonk NY). The significance level was set a priori at $p \leq 0.05$, and all hypotheses were two-tailed. All categorical variables were summarized as absolute frequencies (n) and percentages (%), while all continuous variables have been summarized as means (m) and standard deviations (SD) or median (M) and 95% Confidence Interval (CI), based on the normal or non-normal distribution. The normality of DHL, TRI, ATiPP, SI and their subscales were verified by using the Kolmogorov–Smirnov and Shapiro–Wilk normality tests. The variables 'age', 'number of years of clinical experience', all DHL subscales were logarithmically transformed in order to obtain a normally distributed variable. Participants were stratified in four groups according to the professional category (M.D. specialized in psychiatry, M.D. psychiatry trainees, psychologists and technicians). Furthermore, participants were stratified based on the digitalization index (DIGi) in three groups: "high" (ranged 16–20), "moderate" (ranged 10–15) and "low" level of digitalization (ranged 4–9). The Analysis of Variance (ANOVA) or Kruskal–Wallis test, where appropriate, were used to perform all comparisons across all quantitative indices: digital literacy index [DHL] and related subscales logarithmically transformed; digital readiness index [TRI] and related subscales; DMH acceptability index [ATiPP]; and, DMH social desirability index [SI]) across three groups according to the DIGi index and across four professional categories abovementioned. In addition, DHL, TRI, ATiPP, SI and their subscales were compared regarding all socio-demographic and job-related variables (as investigated in the first section of the questionnaire) such as the sex, current professional/academic role, type of job settings (public versus private), type of professional category, job geographical area, presence/absence of a pre-COVID-19 and/or post-COVID-19 clinical experience in DP/DMH, presence/absence of a theoretical and/or practical training in DP/DMH, through the ANOVA or Kruskal–Wallis test. Pearson's and Spearman's correlations were run for all quantitative variables. Furthermore, DHL,

TRI, ATiPP, SI and their subscales have been also individually entered within a stepwise multivariate linear regression model (as dependent variables) in order to explore whether potential socio-demographic and/or job-related and/or DIGi related variables could represent a predictor(s) of each index. Moreover, several logistic binary regression models were performed by exploring whether DHL, TRI, ATiPP, SI and their subscales could be predictors for the following dichotomous variables (included as dependent within the logistic model): presence/absence of pre-/post-COVID-19 DMH/DP clinical experience; presence/absence of DMH/DP knowledge; presence/absence of DMH/DP formal training; presence/absence of preference of a set of DMH/DP interventions from a list provided to all mental health professionals.

Results

Sample Characteristics

The survey was filled out by 1,390 mental health professionals, after excluding those participants who refused to participate in the study ($N=12$). Most participants were males ($N=987$; 71.1%), with an average age of 37.0 ($\pm$SD = 10.0) years-old, with a good representativeness across all mental health professionals, type of working setting (public versus private) and geographical distribution (Table 1). Most mental health professionals did not have a pre-COVID-19 experience in delivering DMH/DP interventions ($N=1,209$; 87%), these are particularly represented by younger ($p<0.001$) and less experienced professionals in mental health and care ($p=0.004$) and those working in public settings ($p<0.001$). Similarly, most mental health professionals did not have delivered DMH/DP during the last triennium (2020–2023) ($N=993$; 71.5%), these are particularly represented by younger ($p<0.001$), females ($p=0.002$), less experienced ($p<0.001$) mental health professionals and those working in public settings ($p<0.001$) or in the Southern Italian regions ($p=0.040$). Psychiatry trainees, PRT and PE are those less experienced in DMH/DP both in pre- and post-COVID-19 (all, $p<0.001$). Only 6.5% ($n=90$) of mental health professionals have been sufficiently trained in DMH/DP.

Level of Digital Literacy

The average mean DHL score was 63.6 ($\pm$SD = 10.9), without statistically sex-based differences ($p=0.075$) (Table 2).

Table 1 Socio-demographic characteristics of the sample, across all four professional categories

	Total sample ($N=1,389$)	M.D. Psychiatrists ($N=340$)	M.D. Psychiatry Trainees ($N=377$)	Psychologists ($N=328$)	Mental health professionals working in psychiatric education and/or rehabilitation (N = 344)
Sex					
Males, *N* (%)	987 (71.1%)	194 (57.1%)	216 (57.3%)	286 (87.2%)	291 (84.6%)
Females, *N* (%)	402 (28.9%)	146 (42.9%)	161 (42.7%)	42 (12.8%)	53 (15.4%)
Geographical Zone					
Northern Italy	374 (26.9%)	85 (25%)	111 (29.4%)	84 (25.6%)	94 (27.3%)
Central Italy	489 (35.2%)	125 (36.8%)	159 (42.2%)	112 (34.1%)	93 (27.0%)
Southern Italy	526 (37.9%)	130 (38.2%)	107 (28.4%)	132 (40.2%)	157 (45.6%)
Job setting					
Public, *N* (%)	1,032(74.3%)	303 (29.4%)	376 (36.4%)	135 (13.1%)	218 (21.1%)
Private, *N* (%)	357 (25.7%)	37 (10.4%)	1 (0.3%)	193 (54.1%)	126 (35.3%)
Psychotherapy training					
none, *N* (%)	864 (62.2%)	178 (20.6%)	320 (37.0%)	24 (2.8%)	342 (39.6%)
yes, no current practice, *N* (%)	81 (5.8%)	43 (53.1%)	19 (23.5%)	18 (22.2%)	1 (1.2%)
yes, current practice, *N* (%)	444 (32.0%)	119 (26.8%)	38 (8.6%)	286 (64.4%)	1 (0.2%)
Age, mean (SD)	37.0 (10.0)	43.2 (9.8)	30.8 (4.8)	40.6 (9.6)	34.4 (10.1)
Clinical experiences, years, median (95%CI)	8.0 (10.2–11.2–)	10.0 (11.3–13.3)	4.0 (6.8–8.6)	10.0 (10.6–12.6)	9.5 (10.7–12.7)

Northern Italy: Liguria, Lombardia, Piemonte, Trentino, Veneto; Central Italy: Abruzzo, Emilia Romagna, Lazio, Marche, Toscana; Southern Italy: Calabria, Campania, Puglia, Sardegna, Sicilia. *N* sample, *%* percentage, *M.D.* medical doctor, *M* mean, *SD* standard deviation, *CI* confidence interval

Table 2 Digital literacy, acceptability, digital readiness, satisfaction, feasibility indices across four professional categories

	Total sample (*N* = 1,389)	M.D. Psychiatrists (*N* = 340)	M.D. Psychiatry Trainees (*N* = 377)	Psychologists (*N* = 328)	Mental health professionals working in psychiatric education and/or rehabilitation (*N* = 344)	*p*-values
DHL, M (SD)	63.6 (10.9)	63.2 (11.2)	63.1 (10.9)	64.3 (11.1)	63.9 (10.9)	F(2,1386) = 0.870; *p* = 0.456
DHL-OS, M (SD)	10.9 (2.5)	10.8 (2.6)	10.9 (2.5)	10.9 (2.5)	10.9 (2.4)	F(3,1384) = 0.298; *p* = 0.827
DHL-IS, M (SD)	10.1 (2.5)	10.0 (2.5)	9.9 (2.5)	10.2 (2.5)	10.3 (2.3)	F(3,1384) = 1.306; *p* = 0.271
DHL-ES, M (SD)	9.6 (2.4)	9.5 (2.6)	9.5 (2.4)	3.7 (2.5)	9.8 (2.3)	F(3,1384) = 1.052; *p* = 0.368
DHL-DR, M (SD)	9.6 (2.4)	9.4 (2.5)	9.5 (2.3)	9.6 (2.3)	9.6 (2.3)	F(23,1384) = 0.422; *p* = 0.737
DHL-NS, M (SD)	6.7 (2.9)	6.6 (2.9)	6.8 (2.9)	7.0 (3.0)	6.5 (2.8)	F(3,1384) = 2.069; *p* = 0.102
DHL-AC, M (SD)	9.6 (2.6)	9.7 (2.7)	9.4 (2.8)	9.7 (2.6)	9.7 (2.5)	F(3,1384) = 1.506; *p* = 0.211
DHL-PP, M (SD)	7.2 (2.7)	7.2 (2.7)	7.1 (2.8)	7.4 (2.8)	7.1 (2.6)	F(3,1384) = 0.678; *p* = 0.565
ATiPP total, M (SD)	27.1 (6.2)	27.0 (6.3)	27.1 (6.0)	27.0 (6.1)	27.4 (6.5)	F(3,1374) = 0.278; *p* = 0.841
ATiPP index, M (SD)	3.4 (0.8)	3.4 (0.8)	3.4 (0.8)	3.4 (0.8)	3.4 (0.8)	F(3,1374) = 0.278; *p* = 0.841
SI scale, M (SD)	6.8 (1.4)	6.9 (1.4)	6.8 (1.2)	6.8 (1.5)	6.7 (1.5)	F(3,1374) = 0.674; *p* = 0.568
TR, M (SD)		0.96 (2.33)	0.98 (2.07)	0.93 (2.27)	0.95 (2.19)	F(3,1384) = 0.026; *p* = 0.994
TR-OPT, M (SD)	3.6 (0.7)	3.7 (0.8)	3.7 (0.8)	3.6 (0.7)	3.6 (0.7)	F(3,1384) = 0.189; *p* = 0.904
TR-INN, M (SD)	2.9 (0.9)	2.9 (1.0)	3.0 (0.9)	2.9 (1.1)	3.0 (0.9)	F(3,1384) = 1.062; *p* = 0.364
TR-DIS, M (SD)	2.4 (0.9)	2.3 (0.8)	2.4 (0.8)	2.3 (0.8)	2.4 (0.9)	F(3,1384) = 0.991; *p* = 0.396
TR-INS, M (SD)	3.3 (0.9)	3.3 (0.9)	3.3 (0.9)	3.3 (0.9)	3.3 (0.9)	F(3,1384) = 0.206; *p* = 0.892

M mean, *SD* standard deviation, *DHL* digital health literacy total score, *DHL-OS* operational skills, i.e. the ability to use the computer and Internet browser, *DHL-IS* information searching skills, i.e. the ability to use correct search strategies, *DHL-ES* evaluating reliability of online information skills, *DHL-DR* the ability to determining relevance of the information to oneself in a particular situation, *DHL-NS* navigation skills, i.e. the ability to navigate and orientate on the Web, *DHL-AC* ability to add self-generated online contents, *DHL-PP* skills regarding protecting and respecting privacy while using the Internet, *ATiPP* attitudes towards digital psychiatry and digital mental health interventions in psychiatry and psychotherapy, *SI* social influence scale, *TR* technology readiness total score

DHL scores were not influenced by previous pre- and/or post-COVID-19 (respectively, $p = 0.097$ and $p = 0.920$). DHL did not significantly differ across three Italian geographical areas (Table 3). DHL scores do not influence the level of DMH/DP knowledge and/or training (respectively, $p = 0.921$ and $p = 0.680$). DHL score does not significantly differ across three DIGi categories ($p = 0.406$).

DHL showed only a slight positive correlation with the number of years of clinical experience (logarithmically transformed) ($r = 0.053$; $p = 0.049$). DHL showed significant correlations with ATiPP and TR, without any correlation with DIGi (Fig. 1).

No significant differences in any socio-demographic variables were found in none of DHL subscales nor across the three DIGi categories (Table 3) and geographical areas. Those mental health professionals with a previous DP/DMH experience in pre-COVID-19 pandemic are those who significantly display higher levels at DHL-IS ($p = 0.025$) and DHL-AC ($p = 0.028$). However, according to the logistic binary regression analysis, having been involved in a pre-COVID-19 pandemic experience in DMH/DP was only predicted by DHL-AC ($B = 0.097$; $p = 0.005$; $Exp(B) = 1.102$).

Those mental health professionals who currently practice psychotherapy displayed significantly higher DHL-ER scores ($p = 0.043$). No significant differences were found in none of DHL subscales regarding the type of psychotherapy, except for DHL-PP ($p = 0.013$). In fact, statistically significant higher DHL-PP scores were found among professionals

Table 3 Digital literacy, acceptability, digital readiness, satisfaction, feasibility indices across three DIGi categories

	Low DIGi (N=661)	Moderate DIGi (N=629)	High DIGi (N=99)	p-values
DHL, M (SD)	63.3 (11.2)	64.0 (10.4)	62.9 (11.7)	F(2,1386)=0.901; p=0.406
DHL-OS, M (SD)	10.8 (2.6)	10.9 (2.4)	10.8 (2.6)	F(2,1385)=0.870; p=0.419
DHL-IS, M (SD)	10.0 (2.6)	10.2 (2.4)	10.3 (2.5)	F(2,1385)=0.731; p=0.481
DHL-ES, M (SD)	9.6 (2.5)	9.7 (2.4)	9.6 (2.6)	F(2,1385)=0.114; p=0.892
DHL-DR, M (SD)	9.5 (2.4)	9.6 (2.3)	9.7 (2.5)	F(2,1385)=0.561; p=0.571
DHL-NS, M (SD)	6.7 (2.9)	6.8 (2.9)	6.2 (2.9)	F(2,1385)=1.837; p=0.160
DHL-AC, M (SD)	9.5 (2.8)	9.7 (2.5)	9.7 (2.5)	F(2,1385)=0.896; p=0.409
DHL-PP, M (SD)	7.2 (2.7)	7.3 (2.7)	6.7 (2.8)	F(2,1385)=1.836; p=0.160
ATiPP total, M (SD)	27.2 (6.2)	27.1 (6.0)	27.1 (7.2)	F(2,1375)=0.058; p=0.944
ATiPP index, M (SD)	3.4 (0.8)	3.4 (0.8)	3.4 (0.9)	F(3,1375)=0.058; p=0.944
SI scale, M (SD)	6.8 (1.4)	6.8 (1.4)	6.9 (1.5)	F(3,1375)=0.438; p=0.646
TR, M (SD)	1.03 (2.16)	0.85 (2.24)	1.17 (2.36)	F(2,1385)=1.472; p=0.230
TR-OPT, M (SD)	3.67 (0.77)	3.62 (0.74)	3.61 (0.71)	F(2,1385)=1.022; p=0.360
TR-INN, M (SD)	3.03 (0.96)	2.90 (1.02)	3.01 (1.03)	F(2,1385)=2.879; p=0.057
TR-DIS, M (SD)	2.38 (0.89)	2.35 (0.83)	2.28 (0.79)	F(2,1385)=0.595; p=0.552
TR-INS, M (SD)	3.21 (0.89)	3.32 (0.88)	3.17 (0.94)	F(2,1385)=1.187; p=0.305

M mean, *SD* standard deviation, *DHL* digital health literacy total score, *DHL-OS* operational skills, i.e. the ability to use the computer and Internet browser, *DHL-IS* information searching skills, i.e. the ability to use correct search strategies, *DHL-ES* evaluating reliability of online information skills, *DHL-DR* the ability to determine relevance of the information to oneself in a particular situation, *DHL-NS* navigation skills, i.e. the ability to navigate and orientate on the Web, *DHL-AC* ability to add self-generated online contents, *DHL-PP* skills regarding protecting and respecting privacy while using the Internet, *ATiPP* attitudes towards digital psychiatry and digital mental health interventions in psychiatry and psychotherapy, *SI* social influence scale, *TR* technology readiness total score

trained in family psychotherapy compared to those CBT trained. Moreover, it was found that those mental health professionals who prefer to deliver psychiatric and/or psychotherapy intervention face-to-face (vs digitally) are those who display the highest DHL-PP scores (p=0.015). Overall, according to a multivariate linear regression model, mental health professionals with the highest levels of motivators in technology readiness (p=0.001) and those more prone to recommend face-to-face interventions (vs DMH/DP) (p=0.026) predicted the highest DHL-PP levels (p<0.001) (Table 4). Moreover, those mental health professionals who less likely prescribe web-based asynchronous interventions (without a therapist) were those with the highest DHL-NS (p=0.044) and DHL-PP levels (p=0.007). Those mental health professionals much more likely interested in providing DP/DMH interventions in their workplace are those with the highest DHL-IS scores (p=0.024).

Level of DMH/DP Acceptability and Social Influence/Desiderability

The average mean ATiPP total score was 27.1 (±SD=6.2), while the average mean ATiPP index was 3.4 (±SD=0.8), without sex-based differences (p=0.967). Those professionals trained in psychodynamic psychotherapy had the highest ATiPP scores, although it was not observed significant differences with other types of psychotherapy (p=0.816). No significant differences were found in ATiPP scores depending on the presence/absence of a pre- and/or post-COVID-19 clinical experience with DMH/DP (respectively, p=0.705 and p=0.389). ATiPP total score was not influenced either by the level of knowledge (p=0.250) or training in DMH/DP interventions (p=0.917). No differences were found in ATiPP total scores depending on the DIGi category (p=0.944). No differences were found in ATiPP total scores across three geographical areas (p=0.099), despite an increasing trend observed among mental health professionals working in the Northern Italian regions compared to Central Italy (p=0.055).

Interestingly, ATiPP showed significant correlations with SI, DHL and TR (Fig. 1). A multivariate linear regression analysis demonstrated that higher feasibility index (p<0.001), higher social influence scores (p<0.001), higher TR scores (p<0.001), an older age (p<0.001), while lower DHL-PP (B=−0.104; t=−2.397, p=0.017) and lower satisfaction scores (p=0.021) statistically predicted the DP/DMH acceptability factor (F(6,1360)=115.974; R^2=0.338; p<0.001) (Table 5).

The mean SI index was 6.8 (±SD=1.4), without sex-based differences (p=0.545). Similarly to ATiPP, the lowest scores at SI were observed among mental health professionals working in Central Italy compared to both the Northern and Southern regions (both, p=0.020). SI index displayed significant correlations only with ATiPP and TR (Fig. 1). A multivariate linear regression analysis demonstrated that higher feasibility index (p<0.001), higher motivator scores (p<0.001), higher satisfaction scores (p<0.001), while lower DHL-IS (p=0.035) and lower inhibitor scores (p=0.012) statistically significantly predicted the SI factor to the DP/DMH implementation (F(5,1361)=37.636; R^2=0.121; p<0.001) (Table 6).

	DIGi index	ATiPP total score	ATiPP index	SI index	DHL total score	DHL-OS	DHL-IS	DHL-ER	DHL-DR	DHL-NS	DHL-AC	DHL-PP	OPT-TR	INN-TR	DIS-TR	INS-TR
ATiPP total score	0.005															
ATiPP index	0.005															
SI index	0.028	0.378**	0.378**													
DHL total score	0.012	0.096**	0.096**	0.041												
DHL-OS	0.036	0.137**	0.137**	0.018	0.592**											
DHL-IS	0.022	0.108**	0.108**	0.019	0.780**	0.557**										
DHL-ER	0.009	0.105**	0.105**	0.044	0.796**	0.526**	0.804**									
DHL-DR	0.024	0.120**	0.120**	0.044	0.789**	0.517**	0.775**	0.830**								
DHL-NS	-0.011	-0.074**	-0.074**	-0.018	0.077**	-0.206**	-0.259**	-0.268**	-0.260**							
DHL-AC	0.014	0.089**	0.089**	0.034	0.651**	0.445**	0.559**	0.577**	0.566**	-0.295**						
DHL-PP	-0.001	-0.054*	-0.054*	0.026	0.369**	0.007	0.003	0.015	0.021	0.400**	-0.044					
OPT-TR	-0.031	0.339**	0.339**	0.232**	0.158**	0.134**	0.153**	0.131**	0.180**	-0.074**	0.132**	0.069*				
INN-TR	-0.036	0.199**	0.199**	0.126**	0.244**	0.195**	0.268**	0.282**	0.280**	-0.119**	0.160**	0.053*	0.390**			
DIS-TR	-0.010	-0.117**	-0.117**	-0.085**	-0.133**	-0.144**	-0.152**	-0.156**	-0.129**	0.078**	-0.116**	-0.034	-0.073**	-0.054*		
INS-TR	0.011	-0.182**	-0.182**	-0.091**	-0.106**	-0.054*	-0.102**	-0.116**	-0.120**	0.015	-0.039	-0.049	-0.242**	-0.186**	0.320**	
TR	-0.027	0.313**	0.313**	0.193**	0.251**	0.216**	0.274**	0.270**	0.284**	-0.127**	0.174**	0.073**	0.615**	0.648**	-0.543**	-0.670**

High Low ***p<0.05; ** p<0.001.**

DIGi: digitalization index; ATiPP: Attitudes towards Digital Psychiatry and Digital Mental Health interventions in Psychiatry and Psychotherapy; SI: Social Influence scale; DHL: Digital Health Literacy total score; DHL-OS: operational skills, i.e. the ability to use the computer and Internet browser; DHL-IS: information searching skills, i.e. the ability to use correct search strategies; DHL-ES: evaluating reliability of online information skills; DHL-DR: the ability to determine relevance of the information to oneself in a particular situation; DHL-NS: navigation skills, i.e. the ability to navigate and orientate on the Web; DHL-AC: ability to add self-generated online contents; DHL-PP: skills regarding protecting and respecting privacy while using the Internet; TR: Technology Readiness total score; OPT: optimism; INN: innovation; DIS: discomfort; INS: insecurity.

Fig. 1 Heatmap of Spearman's correlation coefficients (ρ) of DIGi, digital literacy, digital acceptability, social influence index, digital readiness, digital satisfaction, and digital feasibility indices

Table 4 Multiple linear regression with DHL-PP (as dependent variable)

	B	SE	β	*t*	*p*-value	95%IC Lower limit	95%IC Upper limit
(*constant*)	5.592	0.420		13.315	**<0.001**	4.768	6.416
MOTIVATORS	0.160	0.049	0.088	3.251	**0.001**	0.063	0.257
Preference for face-to-face Tx (yes)	0.624	0.280	0.060	2.229	**0.026**	0.075	1.173

SE standard error, *DHL* digital health literacy, *PP* privacy concerns, MOTIVATORS include all factors incentivizing technology readiness to digital integration and implementation, as assessed by Technology Readiness Inventory (TRI) scale; *Tx* intervention, *MH* mental health

In bold significant p-values

Table 5 Multiple linear regression with ATiPP index (as dependent variable)

	B	SE	β	t	*p*-value	95%IC Lower limit	95%IC Upper limit
(*constant*)	0.763	0.293		2.605	**0.009**		
Social influence index	0.124	0.013	0.221	9.414	**<0.001**	0.882	1.134
Feasibility index	0.086	0.006	0.408	14.636	**<0.001**	0.627	1.595
TR	0.065	0.008	0.187	8.052	**<0.001**	0.904	1.107
age (in years)	0.231	0.067	0.076	3.465	**0.001**	0.998	1.002
DHL-PP	−0.104	0.043	−0.053	−2.397	**0.017**	0.989	1.011
Satisfaction index	−0.006	0.003	−0.062	−2.312	**0.021**	0.682	1.466

SE standard error, *DHL* digital health literacy, *TR* technology readiness, *DHL* digital health literacy, *PP* privacy concerns

In bold significant *p*-values

Level of Digital Readiness

Overall, 60% of our sample was found to be technologically ready ($N=833$). The mean TR total score was 51.8 (±SD=8.9) (Table 2). No significant sex-based differences were found at TR total score and subscales, except for males who significantly displayed higher TR-DIS scores compared to the female counterpart ($p=0.045$). No significant differences were found depending on the type of job setting (public versus private), except for those mental health

Table 6 Multiple linear regression with SI index (as dependent variable)

	B	SE	β	*t*	*p*-value	95%IC Lower limit	95%IC Upper Limit
(*constant*)	4.485	0.396		11.338	**<0.001**	0.647	1.545
Feasibility index	0.078	0.012	0.206	6.530	**<0.001**	0.896	1.116
TR Motivators	0.121	0.025	0.129	4.805	**<0.001**	0.672	1.487
Satisfaction index	0.018	0.005	0.106	3.416	**0.001**	0.672	1.487
TR Inhibitors	−0.064	0.025	−0.066	−2.509	**0.012**	0.935	1.069
DHL-IS	−0.232	0.110	−0.054	−2.115	**0.035**	0.982	1.019

SE standard error, *SI* social influence index, *DHL* digital health literacy, *TR* technology readiness, *IS* information searching skills

In bold significant *p*-values

professionals working in public settings who reported the highest TR-OPT scores ($p=0.030$). No significant differences were found depending on the type of professional category for any of TR subscales (Table 2). Regarding geographical distribution, mental health professionals working in the southern regions display the highest TR-OPT ($p<0.001$), TR-INN ($p<0.001$) and TR ($p=0.006$) scores, compared to Northern and Central regions.

Higher scores at TR-INN subscale were found among mental health professionals trained for psychotherapy but not practitioners compared to those practitioners and trained ($p=0.010$). The highest scores at TR-DIS subscale were found among mental health professionals trained and practitioners in psychotherapy ($p=0.049$). The type of psychotherapy did not influence TR scores ($p>0.005$).

Overall, mental health professionals with the highest TR scores are those more prone to implement DMH/DP in their clinical practice ($p=0.010$). The main reasons reported by mental health professionals with the highest TR level, for not providing a DMH/DP intervention are: a) the lack of DMH/DP training; b) the lack of safety/protection; c) the impersonal modality; and, d) the poorest efficacy. In particular, mental health professionals with the highest TR-OPT scores mainly reported the following reasons: a) the poorest efficacy; and, b) the highest costs. Mental health professionals with the highest TR-INN and TR-DIS scores mainly reported ethical reasons. Motivations reported did not significantly differ across four professional categories. Conversely, mental health professionals with the highest TR-INS and TR inhibitors scores are those not interested in providing DP/DMH interventions, whether implementable in their workplaces (respectively, $p=0.007$ and $p=0.004$).

Significant correlations were found between TR, DHL, ATiPP and SI (Fig. 1). A multivariate linear regression analysis found that TR scores are significantly predicted by higher ATIPP scores ($p<0.001$), higher DHL total scores ($p<0.001$), higher feasibility scores ($p<0.001$), higher SI scores ($p=0.006$) and lower levels of perceived satisfaction towards DMI/DP clinical experience ($p=0.037$) ($F(12,1354)=38.743$; $R^2=0.256$; $p<0.001$) (Table 7). Moreover, a further

Table 7 Multiple linear regression with TR score (as dependent variable)

	B	SE	β	t	*p*-value	95%IC Lower limit	95%IC Upper limit
(*constant*)	7.315	1.202		6.085	**<0.001**		
ATiPP total score	0.072	0.010	0.203	7.183	**<0.001**	0.689	1.452
DHL total score	0.261	0.023	1.206	11.440	**<0.001**	0.049	20.210
DHL OS	−2.102	0.265	−0.335	−7.934	**<0.001**	0.309	3.241
DHL NS	−2.081	0.181	−0.429	−11.497	**<0.001**	0.395	2.531
DHL AC	−2.004	0.252	−0.323	−7.965	**<0.001**	0.334	2.990
DHL IS	−1.747	0.424	−0.256	−4.121	**<0.001**	0.143	7.009
Feasibility index	0.102	0.019	0.170	5.358	**<0.001**	0.547	1.829
DHL PP	−1.349	0.229	−0.242	−5.883	**<0.001**	0.325	3.073
DHL ER	−1.553	0.461	−0.220	−3.373	**0.001**	0.129	7.766
Satisfaction index	−0.026	0.008	−0.097	−3.413	**0.001**	0.681	1.468
DHL DR	−1.249	0.441	−0.170	−2.832	**0.005**	0.152	6.578
Social Influence index	0.114	0.041	0.072	2.777	**0.006**	0.827	1.209

SE standard error, *SI* social influence index, *DHL* digital health literacy total score, *DHL-OS* operational skills, i.e. the ability to use the computer and Internet browser, *DHL-IS* information searching skills, i.e. the ability to use correct search strategies, *DHL-ES* evaluating reliability of online information skills, *DHL-DR* the ability to determine relevance of the information to oneself in a particular situation, *DHL-NS* navigation skills, i.e. the ability to navigate and orientate on the Web, *DHL-AC* ability to add self-generated online contents, *DHL-PP* skills regarding protecting and respecting privacy while using the Internet, *ATiPP* attitudes towards digital psychiatry and digital mental health interventions in psychiatry and psychotherapy, *SI* social influence scale, *TR* technology readiness total score

In bold significant *p*-values

multivariate linear regression analysis demonstrated that higher ATIPP total scores (B=0.043; t=6.113, $p<0.001$), higher feasibility scores (B=0.064; $t=5.485$, $p<0.001$), higher DHL total scores (B=0.021; $t=5.792$, $p<0.001$), higher social influence scores (B=0.103; t=3.569, p<0.001) while lower scores at DIGi index (B=−0.022, $t=-2.090$, $p=0.037$) statistically significantly predicted the motivator factor to the digital readiness ($F(5,1364)=47.639$; $R^2=0.149$; $p<0.001$). Another multivariate linear regression analysis demonstrated that lower ATIPP total scores (B=−0.040; $t=-5.794$, $p<0.001$), lower feasibility scores (B=−0.042; $t=-3.051$, $p<0.001$), lower DHL total scores (B=−0.015; $t=-4.100$, $p<0.001$) and higher satisfaction scores (B=0.034; $t=6.180$, $p<0.001$) statistically significantly predicted the inhibitor factor to the digital readiness ($F(4,1365)=26.934$; $R^2=0.073$; $p<0.001$).

Discussion

To the best of our knowledge, this is the first study investigating the level of digital literacy and readiness among mental health professionals in Italy with the aim to explore the role of these determinants in the digitalization process of mental health care, by recruiting a multiprofessional and multicentric cohort of mental healthcare providers coming from private and public settings, university, hospital and outpatient mental health services. The current study sub-analyzed three sections of an ad hoc developed questionnaire (Supplementary file 1), in order to explore which individual determinants of mental health workforce can be addressed to develop national initiatives to systematically integrate and implement DMH within Italian mental health services.

Main Findings

Digital Literacy

In our sample, Italian mental health professionals displayed from a moderate to high digital literacy without any significant differences across mental health professional categories, working settings, geographical areas or other socio-demographic variables. In particular, the highest digital literacy levels were found among the most clinically experienced mental health professionals and who regularly practice psychotherapy in their clinical practice, suggesting a professional pattern in DMH/DP choice in Italy. Mental health professionals trained and who regularly practice psychotherapy significantly displayed the highest scores at DHL-ER, i.e. the subscale assessing the presence of adequate competencies in evaluating/discriminating reliability of online information in general (not specifically related to professional information). Moreover, the highest scores at DHL-PP (i.e. the subscale measuring skills regarding protecting and respecting privacy while using the Internet) were reported by those mental health professionals who regularly practice a family-based approach in psychotherapy, by suggesting differential literacy regarding online data protection and safety concerns. This finding could probably be explained by the different scenarios and topics which usually are investigated and treated in a family psychotherapy, and potentially by the influencing online factor in specifically observing and interpreting the family dynamics within the digital setting(s) (Blair et al., 2024). Similarly, mental health professionals who preferentially deliver face-to-face psychiatry and/or psychotherapy intervention (vs digital modality) showed the highest DHL-PP scores, suggesting that this factor could be a possible target in initiatives to implement DMH/DP in Italy. According to these findings, one could argue that privacy and safety concerns may drive/influence the lowest digital propensity in delivering DMH/DP in clinical practice by mental health professionals. Indeed, this finding is coherent with previous literature (Sims-Rhodes et al., 2024), which clearly found the presence of a "critical research gap" in systematically assessing safety issues in DMH interventions, such as adverse effects (Taher et al., 2023, 2024, 2025). Interestingly, the highest DHL-PP scores have been also observed among mental health professionals who mainly choose web-based asynchronous (without therapist) interventions in their clinical practice, among all DMH/DP interventions. These findings could suggest that some personality traits of mental health professionals, particularly those more sensitive to privacy and safety concerns regarding the digital health solutions, could probably influence their openness and attitude to digital implementation. However, despite no comparing studies are available to date, one could argue that implementation strategies should also take into account personality and characters' profile of mental health providers, in order to better understand whether these variables could influence DMH/DP acceptability and readiness. On the other hand, one could suppose that the preference for Internet-based asynchronous interventions could be effectively related to the safety and privacy concerns. In fact, this modality could guarantee a more perceived self-confident, safe and effective way to provide DMH interventions. This modality could be particularly effective and 'safe' whether the clinician has poor DMH/DP knowledge and/or expertise, if the clinician prefers a lower digital active involvement and/or a lower exposure to potential medicolegal issues, as already discussed in previous literature (Brantnell et al., 2023; Gooding, 2019).

Furthermore, in our study, we found that mental health professionals with a pre-COVID-19 DMH experience

display the highest DHL-IS (i.e., higher abilities in using correct online search strategies) and DHL-AC scores (i.e., ability in self-generating online contents), suggesting also these variables as potential targets for DMH/DP implementing strategies. Interestingly, DHL-IS seems to represent a factor influencing the propensity and acceptability of a digital implementation in clinical practice by mental health professionals. Indeed, although one could hypothesize that these levels could be influenced by belonging to the youngest generation, our study did not find any trend based on age and/or clinical experience. Therefore, these factors appear to be not generation- and/or experience-related.

Digital Acceptability and Social Influence

In our study, mental health professionals showed a moderate level of DMH/DP acceptability, without any significant differences across mental health professional categories, working settings or other socio-demographic variables. Only an increasing trend was observed in the levels of DMH/DP acceptability in mental health professionals working in the Northern Italian regions compared to Central Italy. This finding could be partially justified by the differential geographical digital revolution driven by the COVID-19 pandemic in Italy, which started early in the Northern regions (Giansanti et al., 2022; Zeng et al., 2020). Interestingly, according to our findings, the level of DMH/DP acceptability is significantly predicted by a higher perceived social influence and a higher age of mental health professionals. These findings seem to indicate that 'digital immigrants' could be more prone to accept DMH/DP in their clinical practice. Indeed, this finding is in contrast with our initial hypothesis, by posing several concerns regarding the DMH/DP acceptability by the 'digital native' mental health professionals. Overall, one could argue that an implementation strategy for digitalization of mental health systems should be specifically addressed to younger mental health professionals, rather than the oldest generation. On the other hand, these findings also indicate that working with colleagues prescribing and providing DMH/DP interventions in their clinical practice, seems to increase the digital acceptability and proneness of other mental health professionals. Therefore, social influence appears a significant factor useful for DMH/DP implementation strategies. Indeed, in our sample, the 'social influence' factor depends on the DMH/DP satisfaction experienced by clinician and a clinician's pattern characterized by higher technology readiness motivators (such as optimism and innovation). Therefore, whether the clinician has a positive experience in providing DMH/DP and works in a job setting with other colleagues who deliver DMH/DP interventions, is more motivated and prone to accept digital solutions in their routine clinical practice. Indeed, in our study, this finding shows a geographical variability in the Italian context. In fact, mental health professionals working in Central Italy do not appear to be affected by this trend. Hence, social influence factor could not be a universal good target for national implementation strategies.

Contrarily, the lowest DMH/DP acceptability was observed among mental health professionals with the lowest levels of digital literacy regarding privacy and safety issues (DHL-PP) and those with the lowest level of satisfaction regarding a previous experience in providing a DMH/DP intervention. These findings could be supported also by previous literature which underline how safety and legal issues and the perception of a poorer control and a lesser knowledge about these aspects could reduce the propensity of mental health professionals in integrating DMH/DP in clinical practice (Taher et al., 2025). Moreover, previous negative experiences could influence the mental health professional's acceptability. Therefore, adequate training and technical support could improve DMH/DP experience and consolidate the implementing process.

Technology Readiness

Finally, our study investigated the level of technology readiness among mental health professionals, in order to identify which is the Italian pattern regarding proneness, acceptability and perceptions towards technologies and digital implementation in mental health and care. New technologies and digital innovations in healthcare could be experienced and lived by mental health professionals exploiting variable positive and negative reactions impacting the access and use of these tools in routine clinical practice. Some mental health professionals also face trade-offs in their attempts to maximize the value derived from technology-based services without encountering frustration or failure (Parasuraman, 2000). TR represents the motivating and inhibiting mental factors that collectively determine a mental health professional's inclination to use DMH/DP interventions in clinical practice and, indirectly, impact the level of digitalization of mental health services locally. Indeed, Peixoto et al. (2022) already suggested that a positive view towards technology may act as a motivating factor, while a negative view may contribute to inhibiting or reducing technology use. Ali (2019) described positive and negative factors associated with accessing technology, consisting of optimism, innovativeness, discomfort and insecurity. Overall, 60% of our sample declared to be technologically ready. Interestingly, two notable findings were represented by the "Optimism" (TR-OPT) and "Discomfort" (TR-DIS) factors which received the highest average scores among the four dimensions of the TRI model, by suggesting a specific pattern observed in our Italian context regarding mental health

professionals. Indeed, there are no studies specifically assessing TR in a cohort of health professionals working in mental health systems and infrastructures. Therefore, our findings cannot be compared with other international studies or with studies recruiting other healthcare professionals.

Despite these premises, our findings clearly show a specific pattern which should be understood to identify whether these features could guide the next steps in the DMH/DP implementation strategies in Italian mental health care settings. The 'Optimism' dimension reflects a positive attitude towards technology and digitally-delivered interventions, including DMH/DP, and the belief that it provides people with greater control, flexibility, and efficiency in their personal and professional lives. Mental health professionals with an optimistic view are more inclined to embrace new technologies and new digital solutions for prevention, diagnosis, treatment and rehabilitation in mental health and care. In fact, optimistic mental health professionals could be more prone to perceive technology/digital solutions as useful and easy to implement in their routine clinical practice. In our sample, significant higher scores at TR-OPT were found among mental health professionals working in public mental health settings, revealing a general positive attitude towards the innovation and technology/digitalization process, despite the lowest levels of digitalization in public settings compared to the private contexts. One could argue that whereas there is the concrete possibility to implement DMH/DP in public mental health services, Italian mental health professionals are overly prone and open to technological progress in mental health care. Conversely, the "discomfort" (TR-DIS) dimension represents the perceived lack of control over technology and the feeling of being overwhelmed. Mental health professionals with the highest TR-DIS levels are those who experience a certain level of anxiety or discomfort when dealing with technology, DMH/DP interventions and its complexities. The inhibiting factor of "Discomfort" could probably be explained by several potential variables, such as lack/poor education and training in DMH/DP, the lack of a supervision and/or a practical experience by an expert/experienced mentor in providing DMH/DP interventions but also the lack/poor technology infrastructures within mental health systems, the lack of evidence-based guidelines in DMH/DP context, and so forth. In our sample, this dimension is mainly represented in those mental health professionals who regularly practice psychotherapeutic interventions, despite this professional category displaying the highest level of DIGi index (Orsolini et al., 2025b). Therefore, one could argue that probably in the psychotherapy context, DMH/DP is effectively implemented but not adequately supported by evidence-based guidelines. However, further research should be conducted to better explore this variable in the context of digital psychotherapy.

Despite the predominant OPT/DIS trend, we also found interesting results regarding the other two TR dimensions. The dimension of the "innovativeness" (TR-INN) refers to the tendency to be an early adopter of technology and an innovative leader, also early introducing DMH/DP in its own clinical practice and mental health service. Mental health professionals with high levels of innovativeness are those readily engaged with new technologies, digitally-delivered interventions even if the benefits or uncertainties surrounding a particular technology are not yet fully explored. In our sample, psychiatry trainees, PRT and PE display the highest TR-INN levels, by suggesting that probably targeting these categories in implementation strategies of the digitalization could represent the best choice to accelerate the capillary dissemination of DMH/DP nationally. In this regard, the best strategy should include targeted interventions to implement DMH/DP education and training, particularly among the youngest and least experienced mental health professionals, as already suggested by previous Italy-based studies (Orsolini et al., 2022). While those mental health professionals who display higher "insecurity" (TR-INS) are those skeptics about the proper functioning of technology and concerns about potential detrimental consequences following the implementation and adoption of digitally-delivered interventions in their routine clinical practice. The TR-INS dimension, whereas predominant, determines less trust in technological and digital tools, including DMH/DP and hesitancy to adopt them (Parasuraman, 2000; Ali, 2019). In our sample, mental health professionals who displayed the highest TR-INS levels are those who declared the lack of interest in prescribing and providing DMH/DP interventions in their workplace, by suggesting that this variable could indeed decelerate the digitalization process.

Finally, our findings clearly identified the following positive predictors influencing the TR index among mental health professionals: a) digital acceptability; b) social influence; c) digital literacy and perceived feasibility in the DMH/DP implementation process in routine clinical practice. Contrarily, the following negative predictors of TR index were identified in our study: a) a lower perceived satisfaction in delivering DMH/DP interventions to their clients/patients by mental health professionals. The latest finding could be an important target to be addressed as this factor could depend on the level of education/training received, the level of expert's supervised experience received and/or by the available technical equipment and support. Interestingly, another interesting finding coming from our study, is represented by the association between a low DIGi score and the tendency to display higher levels of TR motivators, among mental health professionals. In fact, according to this finding, one could argue that there

is a hope in DMH/DP implementation particularly among those mental health professionals working in job settings with low DIGi score. Therefore, implementation initiatives could find a fertile ground especially in those job settings with current lower opportunities in the field of DMH/DP. While the lowest levels of digital literacy and perceived feasibility, in terms of adaptability and implementation of DMH/DP in clinical practice, as well as the lowest levels of clinicians' DMH/DP acceptability appeared to predict higher scores at TR inhibitor factors towards technology and digital integration. Therefore, these variables should also be targeted in order to improve technology readiness and facilitate the digital revolution in mental health care settings and professionals.

Therefore, a good choice for national implementing initiatives should integrate strategies to improve the technology comfort among mental health providers and reduce the perceived insecurity (such as privacy and safety concerns). These variables could depend on internal factors (i.e., individual character/personality features of mental health provider) or by external factors (i.e., lack of technological support, supervision, mentorship, digital literacy, etc.) (Brantnell et al., 2023). Another relevant recommendation should include initiatives able to improve DMH/DP education/training and knowledge, as our findings indicated that mental health professionals with the highest TR-OPT scores, declared that their main motivations in not providing DMH/DP interventions are the poor efficacy compared to the traditional modality and high costs. Indeed, these reasons seem to not be supported by evidence-based literature on DMH/DP and could be due to the lack/poor level of training and education in this field. Moreover, another interesting target of education/training should include the topic of ethics/safety/privacy concerns, as mental health professionals with the highest TR-INN and TR-DIS scores declared these issues as the main reasons in their choice to not provide DMH/DP interventions. A further recommendation to be followed in building implementing strategies should consider a geographical-sensitive approach. In fact, according to our findings, the highest TR-OPT and TR-INN scores were found in mental health professionals working in the Southern Italian regions, despite the reported lowest levels of post-COVID-19 consolidation of DMH/DP, according to our study. Indeed, this finding is coherent with the finding that most mental health professionals working in Southern Italian regions, declared to be more prone to implement and adapt digital psychiatry in their clinical practice, if they have the opportunity to do it. These findings support the hypothesis that this digital divide could be explained mainly by the lack/poor availability of digital equipment and/or financial resources rather than by individual determinants, at least in South Italy.

Strengths and Limitations

Our findings provided a good representative overview of the current state-of-the-art of digital literacy, technology readiness, DMH/DP perception and acceptability of a large cohort of mental health professionals. Although our study has several interesting viewpoints and insights, useful to guide a targeted approach to digitalization of mental health and care in Italy, it also displays a series of limitations which should be discussed and clarified hereby. Firstly, the cross-section study design does not allow to draw definitive conclusions regarding the causal relationship between the level of digitalization and all variables (predictors) here identified. Secondly, digital literacy was assessed by using a tool measuring basic knowledge and not specifically assessing digital literacy in DMH/DP. However, to date, there are no specifically developed tools able to assess DMH/DP literacy. A further potential study could be to create a tool able to assess this dimension. Thirdly, our findings clearly reported an association between some dimensions of digital literacy and the practice of psychotherapy which suggests the need to perform a case–control study specifically assessing in-person versus online psychotherapy versus blended-mode psychotherapy in order to identify if there are some individual determinants influencing the clinician's preference of one of these modalities in clinical practice. Fourthly, although our findings could suggest that specific patterns of traits and characters of mental health professionals could impact the different TR readiness, in our study we did not include any assessment scales on personality/characters. In addition, our sample did not collect many participants coming from university settings as well as those senior mental health professionals, being our sample mainly constituted by relatively young professionals. However, our recruited sample is statistically representative of current Italian mental health professionals, due to the dramatic generation gap observed in the post-COVID-19 period. Another important limitation is that the research did not find significant sex-based differences in each investigated variable, by limiting any speculative interpretation and consequently clinical implications and future research directions. Hence, although this could potentially limit the generalizability of our proposed implementation strategies to older mental health professionals, it is also true that this sample is more representative of the current Italian picture of mental health professionals, mainly younger and less experienced. Moreover, our study did not specifically assess the qualitative aspect of the findings, by lacking a section of open question(s) useful to collect subjective experiences of mental health professionals. Therefore, a further extension of the study should provide a semi-structured interview addressed to all available mental health professionals, to compare the main motivator(s) of

the digital process. Finally, in our study, we did not assess the impact of an education and training program in DP in the technology readiness levels, digital acceptability and proneness to technology and digital solutions. Hence, future research directions could include to design an interventional study providing an education and training module on DMH since university courses and test whether these variables could be modified and, directly, influence the digitalization process at national level.

Future Research Developments and Policy Recommendations

Our study provided a preliminary picture of a set of individual determinants of the level of digitalization of mental health professionals in the Italian context. Our results should be furtherly investigated within each mental health professional category, by increasing the sample size and collecting further senior participants and those working in university settings. The 'Digital Natives' effect in favoring the highest chance towards the digitalization of mental health systems failed to confirm our initial hypothesis, by rather suggesting that a differential character/personality-dependent pattern could much more likely influence the decision-making process guiding towards DMH/DP. Further studies should better understand the phenomenon among mental health professionals who regularly provide psychotherapy, also comparing those M.D. who use digital modality both in psychotherapy and psychopharmacological prescription, to observe if any differences could emerge across all professionals. Interestingly, Italian mental health professionals, recruited in our study, overly displayed a higher optimistic view but higher discomfort perceptions from technology and digital innovation. This finding suggests that Italian professionals are mostly ready to be techno-digitalicus in mental health care (optimism). However, the experienced 'discomfort' could be probably due to several reasons, e.g. poor adequate infrastructures/services, lack of national regulatory recommendations and guidelines in DMH, a low level of education and training since University courses. Indeed, the overall percentage of mental health professionals who are 'technologically ready' is unexpectedly low in Italy, considered the post-COVID-19 period. This finding suggests that Italian mental health professionals should overcome this dramatic gap, very far from those already reached by other European and non-European countries. The COVID-19 pandemic seemed to have only temporarily accelerated the digital process in Italy, without having been strengthened by national initiatives supportive in the consolidating process. This gap between clinicians' technology readiness and the lag of infrastructures represent one of the major targets to be addressed. Firstly, there is the need to increase financial resources dedicated to DMH implementation in public services. Secondly, there is the need to facilitate the university integration of structured DMH/DP knowledge (by implementing education and training programs). Thirdly, an advanced digital mental health literacy should be guaranteed to all mental health professionals to ensure effective delivery of DMH interventions. Fourthly, a permanent digital navigator/technician is needed to support all mental health professionals in a stage-by-stage process of implementation of digital tools and solutions in public mental health services. Targeted interventions should take into account both national and university-based initiatives to solve this innovation gap and not only address the specialty sector (i.e., psychiatry, psychology, psychotherapy).

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Data Availability The dataset will be provided on request to the corresponding author.

Declarations

Ethical Approval The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki, according to the guidelines for Good Clinical Practice (GCP) and according to the CHERRIES guidelines. The study has been approved by the Ethical Committee of the Marche Region (protocol code DIGIT-PSY n. 62/2023).

Informed Consent Every human participant provided their written consent to participate in the study.

Conflict of Interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

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Authors and Affiliations

Laura Orsolini[1] · Giulio Longo[1] · Mario Luciano[2] · Gaia Sampogna[2] · Andrea Amerio[3,4] · Anna-Rita Atti[5] · Stefano Barlati[6] · Giuseppe Blasi[7] · Paola Calò[8] · Claudia Carmassi[9] · Giuseppe Carrà[10] · Giovanni Castellini[11] · Armando D'Agostino[12] · Pasquale De Fazio[13] · Chiara De Panfilis[14] · Giorgio Di Lorenzo[15] · Matteo Di Vincenzo[2] · Carla Gramaglia[16,17] · Valeria Latorre[18] · Mirko Manchia[19] · Giovanni Martinotti[20] · Mauro Pettorruso[20] · Federica Pinna[19] · Gabriele Sani[21,22] · Gianluca Serafini[3,4] · Maria Salvina Signorelli[23] · Sarah Tosato[24] · Antonio Ventriglio[25] · Umberto Volpe[1]

✉ Laura Orsolini
l.orsolini@staff.univpm.it

1 Clinical Psychiatry Unit, Department of Clinical Neurosciences/DIMSC, School of Medicine and Surgery, Polytechnic University of Marche, Via Tronto 10/A, 60126 Ancona, Italy

2 Department of Psychiatry, University of Campania "L. Vanvitelli", Naples, Italy

3 Department of Neuroscience, Rehabilitation, Ophthalmology, Genetics, Maternal and Child Health (DINOGMI), Section of Psychiatry, University of Genoa, Genoa, Italy

4 IRCCS Ospedale Policlinico San Martino, Genoa, Italy

5 Department of Biomedical and NeuroMotor Sciences, University of Bologna, Bologna, Italy

6 University of Brescia, ASST Spedali Civili of Brescia, Brescia, Italy

7 Psychiatric Neuroscience Group, Department of Translational Biomedicine and Neuroscience, University of Bari "Aldo Moro", Bari, Italy

8 Department of Mental Health, Azienda Sanitaria Integrata Giuliano-Isontina, Lecce, Italy

9 Department of Clinical and Experimental Medicine, University of Pisa, Pisa, Italy

10 Department of Medicine and Surgery, University of Milan Bicocca, Milan, Italy

11 Psychiatry Unit, Department of Health Sciences, University of Florence, Florence, Italy

12 Department of Health Sciences, University of Milan, Milan, Italy

13 Psychiatric Unit, Department of Health Sciences, University Magna Graecia, Catanzaro, Italy

14 Department of Medicine and Surgery, Unit of Neuroscience, University of Parma, Parma, Italy

15 Department of Systems Medicine, University of Rome Tor Vergata, Rome, Italy

16 Department of Translational Medicine, Università del Piemonte Orientale, Novara, Italy

17 Psychiatry Division, Azienda Ospedaliero Universitaria Maggiore Della Carità, Novara, Italy

18 Complex Organization Unit Psychiatric Diagnosis and Care Service UO San Paolo, ASL Bari, Bari, Italy

19 Section of Psychiatry, Department of Medical Sciences and Public Health, University of Cagliari, Cagliari, Italy

20 Department of Neuroscience, Imaging and Clinical Sciences, University "G. D'Annunzio" of Chieti-Pescara, Chieti, Italy

21 Department of Neuroscience, Section of Psychiatry, University Cattolica del Sacro Cuore, Rome, Italy

22 Fondazione Policlinico A. Gemelli IRCCS, Rome, Italy

23 Department of Clinical and Experimental Medicine, AOU Policlinico Hospital, University of Catania, Catania, Italy

24 Section of Psychiatry, Department of Neuroscience, Biomedicine and Movement Sciences, University of Verona, Verona, Italy

25 Department of Clinical and Experimental Medicine, University of Foggia, Foggia, Italy