

RESEARCH ARTICLE

Tools supporting polypharmacy management in Italy: Factors determining digital technologies' intention to use in clinical practice

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Abstract

Background and Aims: INTERCheckWEB is one of the most outstanding digital technologies, that could be implemented at the hospital level, supporting the clinicians in the evaluation of the therapy appropriateness, reducing the potentially inappropriate prescriptions, for the improvement of the clinical decision-making process. The paper aims at investigating the relationship between clinicians' behaviors towards digital decision support system in therapy appropriateness for elderly patients in polytherapy in medical departments, defining the factors that could influence clinicians to use INTERCheckWEB, for supporting drugs' prescription.

Methods: A questionnaire was administered to 70 clinicians referring to Internal Medicine wards, of four Italian hospitals. The authors assessed how perceived usefulness, perceived ease of use, image, and output quality, would affect INTERCheckWeb intention to use. Inferential statistics, by means of a regression analysis, were conducted to define the main aspects useful to understand the factors impacting on such digital technology adoption in clinical practice.

Results: The regression analysis reported that image, perceived ease of use and perceived usefulness, as well as the moderator effect of the voluntary use between the perceived usefulness and the intention to use, are the factors that most influence the use of INTERCheckWEB (adjusted $R^2 = 0.870$).

Conclusions: Results demonstrated that clinicians would use INTERCheckWEB, when available, to identify all the information on situations that could be dangerous for the patients, thus limiting the drug–drug interactions, optimizing the overall patient's clinical pathway. Furthermore, the implementation of INTERCheckWEB could also contribute to the proper management of COVID-19 patients, since both hospitalized and symptomatic COVID-19 patients are frequently older, with comorbidities.

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KEYWORDS

clinical appropriateness, digital technology, drug–drug interactions, INTERCheckWEB, polypharmacy, Technology Acceptance Model

1 | INTRODUCTION

Digital technologies (DTs) are frequently used to improve the decision-making process in hospitals, reducing the complexity of the process management in healthcare sector and limiting clinical errors.^{1–5} As such, DTs would offer new opportunities for identifying needs and delivering healthcare services, potentially transforming healthcare organizations in ways that may contribute to achieve healthcare systems goals (high-quality services, efficiency, equity, affordability, and accessibility to care).^{1–6}

Despite DTs positive impact on the process efficiency improvement, their adoption is usually related to a professional resistance to change, because of DTs being usually perceived as disruptive innovations.

Therefore, considering the importance of correctly assessing the impact of innovative healthcare technologies adoption on the existing clinical pathways, it is important to directly involve all the healthcare professionals in the DTs use.^{4,7,8}

Nowadays, INTERCheckWEB is one of the most outstanding DT innovative technologies that could be implemented, at hospital level, supporting the clinicians in the evaluation of the therapy appropriateness for a patient, specially reducing the potentially inappropriate prescriptions and drug–drug interactions (DDI) for elderly patients in polytherapy.^{9,10}

INTERCheckWEB is a Computerized Prescription Support System, developed by the “Istituto di Ricerche Farmacologiche Mario Negri IRCCS.”¹¹ This is an open-access DT, that aims at storing information about DDI, potentially inappropriate medications, anticholinergic burden, and dose adjustment, in case of renal disease and modality for drug withdrawals. It has a user-friendly interface and could guide clinicians in the evaluation of any possible therapy switches or changes, according to the most recent versions of “Beers” and “START and STOPP” criteria.^{12,13}

The standardized implementation of INTERCheckWEB is acquiring a strong relevance, since polypharmacy in the elderly is estimated to be around 40% of outpatient population, and even higher in hospitalized patients.^{14–18} In addition, with an increasing number of medications, low adherence is a growing concern, seriously undermining the benefits of medical care.¹⁹ The above situation may be aggravated in patients with COVID-19 as the polypharmacy burden is increased by the addition of specific treatments for the virus infection, thus presenting a higher risk to develop DDIs, that would potentially worsen their clinical conditions, independently from the COVID-19 severity.²⁰

Despite the relevance of this tool, no consensus exists, regarding its continuous and routine use, during the phase of drug therapies prescription, thus requiring an in-depth analysis of the clinicians' acceptance to use such DT.^{21,22}

Given the foregoing premises, the study aims at investigating the acceptance and the intentions to use the innovative INTERCheckWEB, for preventive DDIs, by addressing the following research question: “Which are the key factors determining the intention to use INTERCheckWEB, as a DT supporting clinicians in the clinical practice decisions, in medical departments?”

1.1 | NARRATIVE LITERATURE REVIEW

The present research activity focused the attention on the definition of the main factors influencing INTERCheckWEB acceptance and intention to use, analyzed with a narrative literature review approach, thus seeking study areas not yet addressed.^{23–25}

In the extant literature, INTERCheckWEB has been analyzed to highlight its strategic relevance to support the clinicians in choosing the proper medication for specific categories of patients, such as chronic and frail patients in hospitals' medical departments or staying in nursing homes.^{9,10,14–18} Once demonstrated its clinical feasibility and practical effectiveness, no evidence exists with regard to the organizational and/or professional factors that could suggest or facilitate the clinicians' approach towards DT in general (and INTERCheckWEB in particular) within the clinical practice, thus generating an important research gap to be further explored.

Based on these considerations, although technical expertise may present one of the barriers to technology acceptance in healthcare, a large body of research has indicated that social and psychological barriers to technology acceptance are also important.^{26,27}

According to the above, literature suggested several operative models implemented for defining the end-users' acceptance level, to use innovative technologies. Among all the referenced models proposed in the literature for investigating the users' acceptance in approaching DTs, the Technology Acceptance Model (TAM) and its revisions, TAM 2, as well as the unified theory of acceptance and use of technology (UTAUT) were applied.^{28,29}

No literature evidence exists concerning the implementation of these models for INTERCheckWEB acceptance assessment. It should be noted here that UTAUT frameworks have seen little use in the healthcare setting in investigating the technology acceptance for healthcare professionals working in high-intensive knowledge setting, such as hospitals. UTAUT has thus been extensively used in the definition of mobile APP acceptance,^{30–33} thus being little replicable within the healthcare setting. Despite UTAUT is the most popular model to define technology acceptance focusing on the information system, in the healthcare setting TAM and its revisions are more applicable and implementable, given not only the nature of the technology being assessed but also for their parsimony and strong explanatory power.^{34–36}

Thus, TAM and TAM 2 are proposed for identifying factors determining whether healthcare professionals will use health information technology,³⁷ thus appearing to be particularly applicable in this field because they focus their attention on specific variables influencing the use of information technologies. The TAM distinguishes ease of use, perceived usefulness, and attitudes towards using, as the factors which most influence the adoption of new technologies.³⁸

Moving on from these premises, the study is intended to define the main factors predicting the individuals' acceptance of INTERCheckWEB, as innovative DT, in medical departments, based on the following variables derived from the TAM 2 core constructs: perceived usefulness, perceived ease of use, image, and output quality.

For the achievement of the study objective already defined, the following hypotheses were, accordingly, set.

1.1.1 | Perceived usefulness

Perceived usefulness could be defined as “the degree to which a person believes that using a particular system would enhance his or her job performance.”²⁸

The perceived usefulness of INTERCheckWEB is related to the clinician's effort to improve daily activities, and to the proper use of the tool itself, intended to simplify all the activities, aiming at the best quality and safety, for the patient factors.^{26,28,29,35} According to the above, the greater the instrument's perceived usefulness, the greater the clinician's willingness to accept the introduction of INTERCheckWEB in the daily activities.

HP1: Perceived usefulness has a positive impact on INTERCheckWEB intention to use.

1.1.2 | Perceived ease of use

Perceived ease of use could be defined as “the level a person believes that using a specific innovative DT would be free of effort.”²⁸ The perceived ease of use influences the innovation adoption. The ease of use is also influenced by the complexity and compatibility of the innovative system, compared with the current situation.²⁷⁻²⁸

In particular, the greater the simplicity of INTERCheckWEB, the greater the perceived ease of use, the greater the willingness of the clinician to accept this instrument.

HP2: Perceived ease of use has a positive impact on INTERCheckWEB intention to use.

1.1.3 | Image

Image could be defined as “the degree to which the use of an innovation is perceived to enhance a person's status in a social system.”³⁹ If an innovative technology is strongly recommended by the healthcare

organization and the clinician does not embrace this innovation, its image would be negatively compromised. On the other hand, the acceptance of technology and the perceived ease of use of the system would modify the behavior of the clinician, having a positive impact on his image.^{26,33} In this view, the image of the clinician will be improved as much as the use of INTERCheckWEB is welcome by third parties.

HP3: Image has a positive impact on INTERCheckWEB intention to use.

1.1.4 | Quality output

Quality output focuses on the fact that, the information, could be clearer and more detailed, encouraging the clinicians to accept its introduction. The strength of the tool is to provide the clinicians with high-quality information, identifying the best way to manage the individuals and organizational aspects of the process. Flexibility is the aspect that best summarizes the tool characteristics, and it is expected to strongly encourage the clinicians to adopt this DT.³³ The greater the flexibility of INTERCheckWEB, meant as the ability of the system to provide information for each investigated element, the greater the quality of the requested output, therefore, the propensity of the clinician to use this instrument.

HP4: Quality output has a positive impact on INTERCheckWEB intention to use.

Despite the direct relationships between the above-mentioned independent variables and INTERCheckWEB intention to use, the proposed framework also includes two moderator variables (voluntary use and experience).

1.1.5 | Voluntary use

Voluntary use is related to people perceptions. In workplace environment, the employees' resort to tools because they are influenced by the circumstances.³³ The matter, hereby investigated, is the clinicians' willingness to break down the traditional barriers that may impede the innovation acceptance.⁴⁰ Thus, the clinician is more likely to use INTERCheckWEB if the willingness to overcome traditional barriers is higher.

HP5: Voluntary use positively moderates the relationship between perceived usefulness and INTERCheckWEB intention to use.

1.1.6 | Experience

Perceived usefulness and intention to use innovative DTs could be higher with increasing experience over time. The experience level of healthcare professionals could act as an important predictor in a

higher level of perceived usefulness and use for various healthcare technologies. Furthermore, as individuals gained direct experience with a system, they relied less on social information in defining perceived usefulness. However, they continued to judge a system's usefulness, based on potential status benefits, resulting from its use.³³

Based on the above, the following hypotheses were developed.

HP6: Experience positively moderates the relationship between perceived usefulness and INTERCheckWEB intention to use.

HP7: Experience positively moderates the relationship between image and INTERCheckWEB intention to use.

A synthesis of the research framework is proposed in Figure 1.

For a more comprehensive framework, a set of control variables was investigated: (i) clinicians age (in terms of how old the clinician is in years); (ii) clinicians working experience (in terms of number of years the clinician has been working); (iii) DT attitude (in terms of clinician's attitude of adopting innovative DTs, according to a 5-level evaluation scale), and (iv) DT skills (in terms of clinicians' capability to use digital instruments, according to a 3-level evaluation scale).

2 | METHODS

A study design composed of the following three phases was conducted.

1. Adaptation of the existing scales for a specific healthcare sector questionnaire

A specific questionnaire was developed to gather clinicians' perceptions, concerning their intention to use INTERCheckWEB.

The questionnaire, based on validated English scales, was translated into the Italian language, to avoid comprehension concerns (please see File S1).

Before administering the questionnaire, a draft was reviewed by five experts, thus creating consensus regarding the contents, to verify the coherence and the comprehensibility of the document, especially in the adaptation of some sentences, from other sectors, to the healthcare one.

Before analyzing data, the problem of common method variance was addressed and solved, with an ex-ante (by maintaining the anonymity of respondent) and an ex-post approach (by conducting the Harman's single-factor test, useful to verify an acceptable level of bias). Thus, an exploratory factor analysis was carried out, to establish if changes introduced in the adaptation process for healthcare sector had affected the structure of the scales.

All the items presenting a factor loading higher than 0.3 were included in the creation of variables, because of the maximization of each construct variance, along one dimension. Furthermore, to assure the reliability of the constructs, the assessment of Cronbach's α was implemented. A cut-off threshold of 0.7 was used to test the items and create the new variables, useful to verify the study hypotheses.⁴¹

2.1 | Data collection in Italian hospitals wards

The sample of the study was composed of head physicians, clinicians, and hospital clinical managers of first and second level ($N = 70$) referring to the Internal Medicine wards, of four Italian medium-size hospitals, after having received the approval by the Healthcare Directorates according to the study protocol number 5135 (Class 03.08.01) dated February 8, 2019.

It should be noted that the sample was based on a convenience approach, according to a snowball sampling technique, that is a commonly

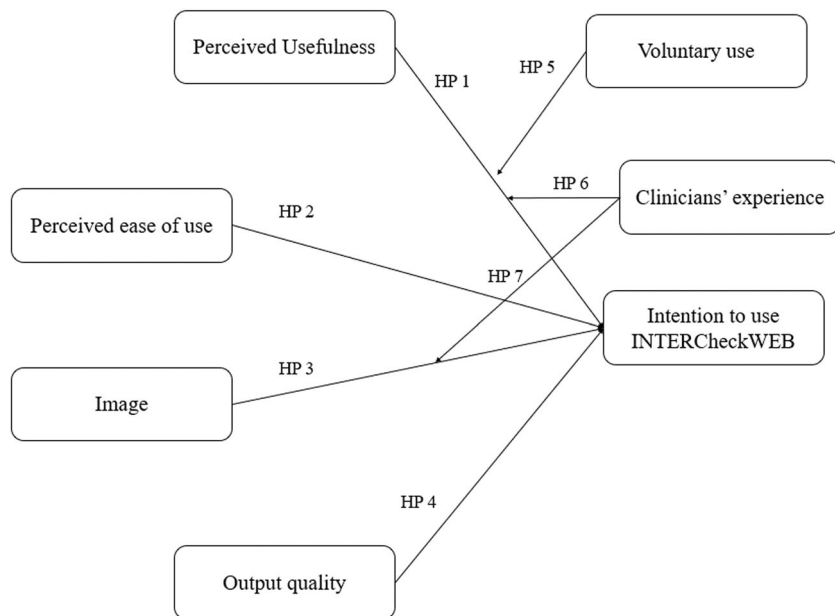


FIGURE 1 Variables tested.

employed sampling method in qualitative research, used in medical science.^{42–46}

All the clinicians involved in the study were representative of the experts working in the Internal Medicine Wards, and taking rotations in the Emergency Departments, thus being clinicians usually devoted to the management of elderly patients with multiple chronic diseases and taking several medications. The clinicians involved, voluntarily participated in the study, filling in the questionnaire declaring their perceptions. The questionnaires were collected and then processed in an anonymous and aggregated manner.

In June 2019, they completed the questionnaire previously defined, through an interview conducted by a trained interviewer, with specific competences both in managerial arguments and in social qualitative study.

Besides the personal information related to each respondent (professional role, age, seniority, and working experience), the questionnaire was composed of a qualitative section in which a 7-item Likert scale was implemented (1: *completely disagree*; 7: *completely agree*). In particular, the interview process aimed at getting the clinicians' insight concerning their intention to use INTERCheckWEB and the independent/moderator/control variables previously described that are perceived usefulness, perceived ease of use, image, quality output, voluntary use, as well as IT skills and attitude.

2.2 | Data analysis

Data derived from the questionnaire were first analyzed considering descriptive statistics. Preliminary analyses were performed to ensure no violation of the assumptions of normality, linearity, and homoscedasticity. In addition, differences among sample subgroups were defined by means of independent sample *t*-tests and contingency tables. Quantitative variables were presented as average value \pm standard error, and qualitative variables were presented as counts or percentages.

Furthermore, inferential analyses were conducted.

1. Relationships between the variables were investigated, to test the existence of correlations among them. In particular, the “Pearson product-moment” correlation coefficient was assessed, to test the existence of small (from 0.10 to 0.29), medium (from 0.3 to 0.49), or large (from 0.5 to 1) correlations among variables.⁴⁷

2. A final investigation of the relationship among the variables, using a hierarchical sequential linear regression model (with enter methodology), was implemented to test the hypotheses; this is useful to establish the impacts of independent variables and moderators. In particular, the adjusted R^2 was examined, to gauge the explanatory power of each model.⁴⁸ This approach allows testing the hypotheses, through incremental models to establish the specific impact of each single input variable, on the dependent variable. The option “exclude case pairwise” was implemented, as it is the preferable methodology, for a small sample and precludes any kind of data exclusion. Three different models were developed, thus defining the influence of the different set of variables (control, independent, and moderator variables), on the dependent variable (INTERCheckWEB intention to use).

- Model 1: Model composed of only the control variables (clinicians age, clinicians working experience, clinicians' IT skills, clinicians' IT attitude).
- Model 2: Model composed of Model 1, with the inclusion of the independent variables (perceived usefulness, perceived ease of use, image, and output quality).
- Model 3: Model composed of Model 1 and Model 2, with the inclusion of the moderator variables (moderator effect of voluntary use and experience).

All the statistical analyses were performed using the IBM SPSS Statistics Viewer—Version 25, and a significance level equal 0.05 was assumed.

3 | RESULTS

3.1 | The sample under assessment

The sample was composed of 70 clinicians (Table 1), most of them being females (63%). In general terms, the average age of the clinicians involved was 45.23 ± 0.92 years old, with a working experience of 16.14 ± 1.02 years.

The sample involved presented a good propensity to use innovative DTs, information technologies, or PCs. Only 3% of them declared a lower propensity to use such technologies. In general, the clinicians involved could be considered supporter of the innovation, since they declared to

TABLE 1 The sample under assessment.

	All	Male	Female	<i>p</i> -Value
Age—years (average \pm SE)	45.23 \pm 0.92	49.77 \pm 1.56	42.55 \pm 0.92	<0.001
Working experience—years (average \pm SE)	16.14 \pm 1.02	18.92 \pm 1.55	14.27 \pm 1.29	0.027
Professional role—first level medical manager (%)	74.29%	53.85%	86.36%	0.003

TABLE 2 Resume of variables.

Construct	N	Number of items in the original scale	Number of validated items	Explained variance (%)	Cronbach's α
Perceived usefulness	70	6	6	98.27%	0.982
Easy to use	70	6	6	86.63%	0.969
Voluntary use	70	3	2	65.85%	0.712
Imagine	70	3	3	76.92%	0.850
Output quality	70	2	2	91.83%	0.911
Intention to use	70	2	2	97.91%	0.978

TABLE 3 Correlations among variables.

	1	2	3	4	5	6	7	8	9	10	11	12
Intention to use (1)	1											
Clinician age (2)	-0.090	1										
Clinician experience (3)	-0.104	0.763**	1									
DT attitude (4)	0.740**	-0.033	-0.110	1								
DT skills (5)	0.498**	0.066	-0.012	0.536**	1							
Perceived usefulness (6)	0.887**	-0.161	-0.092	-0.812**	-0.506**	1						
Perceived ease of use (7)	0.828**	-0.183	-0.137	-0.777**	-0.473**	0.827**	1					
Image (8)	-0.087	-0.115	0.101	-0.035	-0.035	0.136	0.121	1				
Output quality (9)	0.757**	-0.234	-0.202	-0.608**	-0.272*	0.781**	0.794**	0.206	1			
Perceived usefulness \times voluntary use (10)	0.441**	-0.041	0.057	-0.139	-0.292*	0.274*	0.299*	-0.223	0.329**	1		
Perceived usefulness \times experience (11)	0.769**	-0.194	-0.014	-0.785**	-0.549**	0.888**	0.794**	0.202	0.704**	0.329**	1	
Image \times experience (12)	0.008	-0.230	0.151	-0.119	-0.197	0.197	0.160	0.865**	0.229	0.005	0.346**	1

* $p \leq 0.05$; ** $p \leq 0.01$.

be prone to adopt any DT able to facilitate their daily activities, and the therapy prescription.

3.2 | The reliability of the scales

The reliability of the scales, and the related constructs were assessed, proving the freedom of the scale from the random error, and establishing their internal consistency.

Detailed information is shown in Table 2.

3.3 | Testing the hypotheses

Perceived usefulness, perceived ease of use, image, and output quality were deeply analyzed, to define their positive or negative

impact on the dependent variable (INTERCheckWEB intention to use). In this view, both the strength and the linear relationship between variables were described.

Table 3 depicts that INTERCheckWEB intention to use was strongly related to a higher DTs attitude ($\beta = 0.740$, $p < 0.001$), higher DT skills ($\beta = 0.498$, $p < 0.001$), a greater perceived usefulness ($\beta = 0.887$, $p < 0.001$) and ease of use ($\beta = 0.828$, $p < 0.001$), and a high-quality output ($\beta = 0.757$, $p < 0.001$). Furthermore, the moderator effect of the voluntary use and experience on perceived usefulness ($\beta = 0.441$, $p < 0.001$ and $\beta = 0.769$, $p < 0.001$, respectively) presented a positive relationship with the dependent variable.

Focusing on the relationships between the control and the independent variables, the following considerations emerged.

1. The higher the DTs skills, the higher the attitude of the clinicians to use DTs ($\beta = 0.536$, $p < 0.001$). Both aspects are consequently

related to a greater perceived INTERCheckWEB usefulness and ease of use ($p < 0.001$). DTs skills and the attitude of the clinicians to use DTs are also related to output quality ($\beta = 0.272$, $p = 0.0203$ and $\beta = -0.608$, $p < 0.001$, respectively).

2. A strong relationship was reported between the perceived usefulness and the perceived ease of use: the higher the perceived usefulness, the higher the perceived ease of use ($\beta = 0.827$, $p < 0.001$). The perceived usefulness and the perceived ease of use also present a strong relationship with output quality ($p < .001$).

A regression analysis was conducted to test the hypotheses. Table 4 reports that no control variables could be considered an antecedent of the intention to use INTERCheckWEB. On the other hand, image, perceived ease of use, and perceived usefulness, as well as the moderator effect of the voluntary use between the perceived usefulness and the intention to use, are the factors that most influenced the use of INTERCheckWEB (adjusted $R^2 = 0.870$).

Thus, the analyses demonstrated that, at least in the investigated setting, INTERCheckWEB intention to use is strictly dependent on

TABLE 4 Regression models.

	Model 1	Model 2	Model 3
Control variables			
Clinician age	0.083	0.089	0.134
Experience	-0.244	-0.005	-0.080
DT skills	0.136	0.084	0.040
DT attitude	0.692*	0.134	0.034
Independent variables			
Perceived usefulness		0.647*	0.735*
Perceived ease of use		0.273*	0.276*
Image		-0.229*	-0.248*
Output quality		0.161	0.091
Moderators			
Perceived usefulness \times voluntary use			0.129*
Perceived usefulness \times experience			-0.169
Image \times experience			0.110
R^2	0.598	0.876	0.891
Adjusted R^2	0.573	0.860	0.870
F-value	24.138*	54.107*	42.940*
ΔR^2	0.598	0.279	0.014
F (ΔR^2)	24.138*	34.426*	2.502

Abbreviation: DT, digital technologies.

* $p \leq 0.05$.

the usefulness and the ease of use perceived by the clinicians (Figure 2).

4 | DISCUSSION

The presence of comorbidities/multiple chronic diseases and the related prescription of complex medications are becoming typical problems, particularly in medical wards and departments, and present many professional challenges.^{49,50} The issue of "polypharmacy" and high dosage frequency are both associated with high rates of adverse drug reactions, poor adherence, and recurrent hospitalization, requiring a simplification of drug regimens.^{51,52}

Thus, any strategy able to prevent potentially severe DDIs, and able to support the clinicians in prescribing the right therapy could play a crucial role in advancing management of chronic illnesses and polypharmacy.^{53,54} This is becoming even more important in COVID-19 hospitalized and symptomatic patients, for whom the pharmacological burden may be further aggravated by the addition of treatments for COVID-19 patients, thus incrementing the risk for developing DDIs.^{19,20} Thereby, assessing DDIs is of primary importance in the context of COVID-19 therapy where older patients and those presenting with comorbidities (hypertension, diabetes, chronic kidney disease, etc.) are individuals particularly at risk for severe illnesses.^{55,56}

In this view, INTERCheckWEB could support clinicians in choosing the right drug and the right dosage, when managing complex patients affected by several concomitant diseases, thus preventing the development of DDIs.

The literature evidence available on the topic has demonstrated the efficacy profiles of INTERCheckWEB, in terms of a significant reduction in potentially inappropriate medications and new-onset potentially severe DDIs, thus being an important strategy for optimizing medications' prescription for elderly patients.^{17,57} Given the proven efficacy, since INTERCheckWEB is a free and open access tool and grounds its use only on the Internet connection presence, it does not report any economic or organizational concerns. In this view, no inter-operability problems emerged in the routine adoption of INTERCheckWEB. The only issue that required an in-depth evaluation from an organizational point of view could be the resistance to adopting the innovative DTs, thus being the only potential barrier in limiting the diffusion and consequent implementation of INTERCheckWEB. This is acquiring a strategic relevance since the future of healthcare is likely to be increasingly digital and recognizing the importance of DTs.⁵⁸

Moving on from the above, and due to the poor INTERCheckWEB effective use in the clinical practice, the study aimed at showing the existence of possible determinants and predictors of the digital solutions' intention to use, useful to prevent potential errors in prescribing drugs. The main factors enhancing INTERCheckWEB intention to use are represented by the perceived usefulness and ease of use, by increasing efficiency, lowering costs, and improving

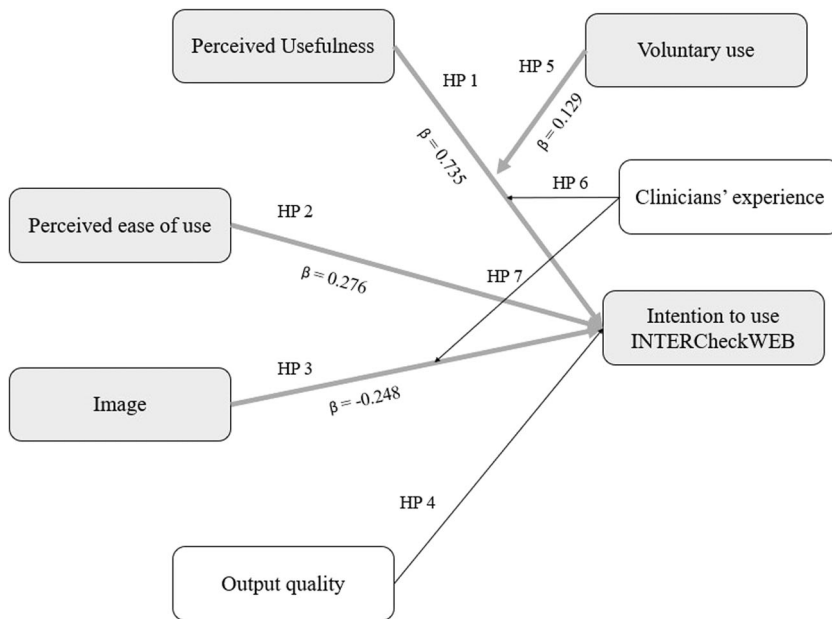


FIGURE 2 Variables tested and verified.

the quality and safety of their care. These results could be consistent with other studies conducted within the healthcare sectors, focusing on telemedicine services.^{59,60} In fact, the ease to use DTs and the adequate experience using the technology assist the user to adjust their beliefs about computer self-efficacy and reduce computer anxiety.^{61,62}

A negative relationship emerged between image and INTERCheckWEB intention to use. Clinicians would not utilize INTERCheckWEB for enhancing their “status symbol,” but they voluntarily would use the innovative technology only if they are able to find a real usefulness and advantage for improving patients' health results.

The lack of statistical significance concerning the output quality, could be related to the fact that not all the clinicians were aware of the INTERCheckWEB existence. In fact, this outcome is not consistent with other acceptance analysis conducted within the healthcare sectors, where one of the most important factors enhancing the adoption of DTs is represented by greater amount of valuable information generated.⁶³

No statistically significant differences were found, regarding the seniority of the respondents, thus demonstrating that no digital divide exists for this context. The same trend was found concerning both clinicians' DT skills and DT attitude: at least in the investigated setting the lack of DT knowledge does not represent a barrier to accept innovative technologies. The adoption of INTERCheckWEB could also present a relevant medical-legal impact: since it represents an updated digital solution, grounded on the most recently published clinical evidence, and being capable to reduce potential prescribing errors, its adoption could help clinicians in making evidence-based choices, thus limiting the occurrence of potential lawsuits. In this view, the routine adoption of such DT presents a strategic legal relevance, since in the last 20 years, in Italy, the lawsuits against hospitals and clinicians have greatly increased.⁶⁴ Italy has by far the

highest proportion of malpractice lawsuits settled in courts among the largest mainland European Countries (90% in 2014 compared to 60% in France and 40% in Germany), thus negatively affect the public healthcare system.⁶⁵ For example, the Chief prosecutor of Rome recorded a 40% increase in the number of complaints filed against clinicians for alleged professional malpractice from 1999 to 2007,⁶⁶ attested at 47.3% in 2019.⁶⁷

From an organizational point of view, based on the above considerations, the institution of communication campaigns to reveal the existence of INTERCheckWEB could represent a useful strategy to maximize its implementation in the clinical practice.

Based on the results presented, an important topic of further research would be the analysis of the variables included in the model, by means of structure equation modeling, to make the results more robust, and to define if any important changes occur in the definition of the predictors of INTERCheckWEB intention to use, integrated with the definition of the potential relationships with patients' clinical factors.

Another topic for further research could be an evaluation of the economic gain related to a reduction in drugs prescribed, that could consequently reduce the economic burden of the management of a chronic and elder patient.⁶⁸

5 | CONCLUSIONS

DDIs are not always baleful; they could, in fact, become indispensable players for the personalization of treatments, useful to reach the expected results, relevant for the improvement of the patients' overall clinical conditions. This approach plays a crucial role in complex and comorbid patients, such as elderly or COVID-19 patients^{69,70} that represent “frequent users” of Medical Departments, in the last few years.

At the same time, it is also important to optimize the therapeutic strategies, to reduce the risks associated with the combined use of unnecessary or potentially hazardous molecules, as well as to enhance the patients' adherence to medications.^{71,72}

In this context, two additional elements play a key role: the identification of the prescriptions to be suspended, and, above all, the therapeutic decision process, held by the clinicians. In the proposed analysis, INTERCheckWEB could support hospitals and clinicians for both factors, achieving a twofold objective. Why not implement this technology, which is able to guarantee a double support to healthcare professionals and organizations?

Every technological innovation able to support decision-making process in the healthcare context has had a controversial development and use, which depends on perceptions and technical factors: technology acceptance and, above all, economic availability.

It is difficult to allocate sufficient IT and technologies investment in the hospitals, in Italy, where a competing demand for equipment and staff exists.⁷³ It is well recognized, in the healthcare sector, the existence of a moral imperative toward innovations, directly impacting on the improvement of patients' outcomes. On the other hand, if technologies and DTs indirectly improve the patients care and the patients point of contact, investment could be perceived less favorably by hospitals c-suites.⁷⁴

INTERCheckWEB is an open access and free of charge source of information, needing only a laptop station, to support the clinicians and directly resulting in the reduction of adverse events. Due to these reasons, the main factors impacting on the introduction of the technologies are only related to clinicians' perceptions and technologies technical aspects.

The analysis has demonstrated that clinicians would effectively use INTERCheckWEB, when available in the hospitals, without experiencing problems of connections. The clinicians perceived the potential positive impact of the DT in the timely and aggregated identification of all the DDIs potentially dangerous for the patients, thus choosing the proper drugs and preventing also medical errors.

To enhance the use of INTERCheckWEB in hospitals, organizational activities could be planned. Training and dissemination activities should be planned, positively impacting on the clinicians, as well as the creation of operative procedures introducing the use of INTERCheckWEB, as standardized support in Medical Departments personalizing treatment for elderly patients, with important benefits also considering the present COVID-19 pandemic.

AUTHOR CONTRIBUTIONS

Emanuela Foglia, Antonino Mazzone, and Luca Varalli conceived the study. Elisabetta Catrini, Lucrezia Ferrario, and Federico Gatti collected and analyzed data. Emanuela Foglia, Elisabetta Catrini, and Lucrezia Ferrario wrote the paper. Lorella Cannavacciuolo and Cristina Ponsiglione critically reviewed the paper. All authors have read and approved the final version of the manuscript. Lucrezia Ferrario had full access to the study data and takes complete

responsibility for the integrity of the data and the accuracy of the data analysis.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

TRANSPARENCY STATEMENT

Lucrezia Ferrario affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

DATA AVAILABILITY STATEMENT

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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