Blood donors’ usage intentions of donation appointment-scheduling systems during the COVID-19 pandemic and beyond

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Abstract
During the COVID-19 pandemic, online appointment-scheduling systems have become standard procedure in blood donation practice. This study develops and empirically tests a comprehensive conceptual model of blood donors’ usage intentions of a donation appointment-scheduling system during the COVID-19 pandemic. Online survey data are collected from blood donors (n = 3269) and analyzed using the partial least squares structural equation modeling (PLS-SEM) approach. The results provide evidence that intentions to use the system in the post-COVID-19 future are high. Together with high-perceived usefulness and ease of use, this indicates generally high-system acceptance among active donors during the pandemic and beyond. The study identifies a number of factors that influence this acceptance. The results show that different aspects of service quality perceptions in the context of the system drive its acceptance. The strongest positive effect is exerted by blood donors’ pre-donation planning convenience, followed by an enhanced actual donation experience. Reduced flexibility as a result of the system has a strong negative effect. The authors derive managerial implications for blood donation services regarding preserving the acceptance level and suggest future research prospects.

KEYWORDS
blood donor behavior, COVID-19, donation appointment scheduling system, technology acceptance

1 | INTRODUCTION

Given the need to limit interhuman contact because of the global COVID-19 pandemic, online appointment-scheduling systems have become standard procedure—almost overnight—in business as well as nonprofit contexts. In the healthcare domain, for example, people book their appointments for COVID-19 vaccinations through such systems; customers book shopping timeslots or, in our case, blood donors book donation appointments. Recently, some studies, including this special issue, have called for more research on blood donor behavior in the COVID-19 context (Haw et al., 2021), which implies rapidly increasing use of digital solutions and technologies. However, in blood donation research, little knowledge is available on blood donors’ usage intentions of such technologies during and beyond the pandemic.

In blood donation practice, managers also reflect upon this issue and inquire how they can optimize donation appointment-scheduling systems to support donor retention. German Red Cross (GRC) blood
donation services, for example, reacted to COVID-19 by making their existing, but nearly unused, donation appointment-scheduling system (DASS) mandatory for every blood donation.

The DASS is an online website where blood donors select and book a fixed timeslot at a specific site for their blood donation. This facilitates better planning and minimizes the chance of crowding at donation sites, which helped meet contact limitation and social distancing regulations during the pandemic (Baş Güre et al., 2018; Zhao et al., 2017). Before the COVID-19 outbreak (until the first weeks of 2020), the number of blood drives facilitated by the DASS was extremely low, and most German blood donors simply appeared at blood donation sites without prior appointments. Very few donors voluntarily booked appointments via the DASS. At that time, blood donation services tried to promote the DASS with low-marketing pressure, handing out flyers and occasionally sending out special information letters.

The situation drastically changed with COVID-19. All blood drives were immediately shifted to mandatory reservations via the DASS, and blood donors were informed about this in their regular invitation letters. Hotlines supported those donors who were not able to use the system themselves. Those donors who appeared at the donation site without booking were handled with regional differences. In most regions, blood donation staff tried to fit persons without appointments into the schedule so that they were not rejected on-site. In other regions, they were more strictly turned away. According to data provided by the GRC Blood Donation Services Baden-Württemberg-Hessia and North-East, the proportion of those insisting on donating without reservations steadily decreased during the course of the pandemic. In June 2021, more than 90% of all those willing to donate had booked their appointments via the DASS (GRC, 2021a).

In general health care in Germany, online self-service appointment scheduling was not a common practice before COVID-19. As Santana et al. (2010) reveal, in 2007, only 3.2% of the inhabitants of seven European countries, including Germany, had previously used the internet to schedule appointments with their doctors. For the DASS in blood donation, it is questionable whether recent high-usage levels can be maintained if the governmental COVID-19 contact-limitation regulations no longer justify the system’s obligatory character. It is conceivable that usage intentions will decrease because blood donors want to go back to pre-pandemic drop-in donations. This in turn could have negative effects for donor retention since evidence from previous research has shown that if consumers feel forced to behave in a certain manner, it may negatively affect their loyalty (Fullerton, 2003; Gundlach et al., 1995). We therefore aim to answer the overarching research question: “How can blood donors’ intentions to use the DASS be maintained beyond the COVID-19 crisis?” Against this background, this study targets two sub-goals: from a blood donor perspective, we aim to (1) assess intentions to use the DASS during the COVID-19 pandemic and beyond, and (2) identify and explore factors that might influence blood donors’ intentions to use such systems.

Through our empirical study, we address the need for research on changes in blood donors’ behaviors induced by the COVID-19 pandemic and contribute to the literature in two ways. First, we develop a model that explains technology acceptance and its antecedents in the context of blood donations. Second, we provide empirical evidence for our model of DASS acceptance in the unique COVID-19 context. Based on our study’s findings, we propose distinct marketing strategies that can help blood donation services stabilize usage intentions of their DASS in the post-COVID-19 era. Optimization and successful promotion of DASSs will help blood donation services maintain their usage intentions and thereby retain blood donors in the future where DASSs will prevail as a mainly obligatory prerequisite to blood donation.

2 | THEORETICAL BACKGROUND AND HYPOTHESES DEVELOPMENT

During COVID-19, acceptance of various technologies was dramatically accelerated by lockdown and quarantine measures. In response to the need for solutions to accomplish tasks under pandemic conditions, barriers that were previously insuperable were suddenly overcome, including in the fields of health, learning, and working (Brem et al., 2021; Budd et al., 2020; Dhawan, 2020; Hantrais et al., 2021). Regarding acceptance of appointment scheduling technology in blood donations, we infer that general acceptance for facilitating technology also increased in this context.

Consequently, we conceptually draw on one of the most influential theoretical models that conceptualizes users’ acceptance and adoption of technology, the technology acceptance model (TAM), which was originally developed by Davis (1989). According to the original TAM model, technology acceptance is constituted by the intention to use a technology together with its perceived ease of use and perceived usefulness (see Figure 1). The model has been acknowledged and empirically tested in different research areas and contexts (King & He, 2006; Legris et al., 2003; Maranguini & Granić, 2015; Sharp, 2007). Besides TAM research in public contexts, like the health care sector (Holden & Karsh, 2010; Rahimi et al., 2018) or in education (Granić & Maranguini, 2019), there are very few applications in the traditional nonprofit context. Hume (2015) combined the concept of service quality and value with the TAM to study customer technology at museums. Slatten (2012) used the TAM to explain participation in nonprofit certification programs. Zheng (2020) and Weberling and Waters (2012) integrated the TAM into their research model on mobile fundraising technology.

The acceptance of appointment scheduling systems is mostly studied in health care literature. Zhang et al. (2014) investigated acceptance of appointment scheduling systems in health care in Australia based on the TAM and identified facilitators and barriers of adoption like computer literacy and communication preferences. Kumar and Natarajan (2020) extend the TAM by integrating expectation-confirmation constructs and external variables like perceived service quality to explore intention to use e-health services that include appointment scheduling in India. Chen et al. (2013) extend the TAM by including relationship quality to study usage intentions of appointment scheduling systems in Taiwan. Ultimately, there is scant evidence on applying such systems in blood donation management, and the few existing studies have focused on technical
details, such as the underlying stochastic algorithms (Baș et al., 2018; Yağcndağ et al., 2020).

In the specific blood donation context, the TAM has been used very few times. Appiah et al. (2018) applied the model to research intentions to download mobile phone tunes that promote blood donation. Gombachika and Monawe (2011) used the model to explain the relationship between SMS technology acceptance and donation behavior. The TAM’s scarce application in blood donation research is rather surprising, since it is rooted in the theory of reasoned action (TRA), which is widely used in blood donation research. This behavioral theory seeks to explain how motivational influences drive human behavior (Fishbein & Ajzen, 1975). Together with its extension, the theory of planned behavior (TPB) (Ajzen, 1991), it is one of the most established theories used to predict blood donation behavior (Ferguson, 1996; Godin et al., 2007; Masser et al., 2009). Recently, Torrent-Sellens et al. (2021) used the TPB to explain participation in digital blood donation community platforms. We assume that the TAM is suitable for studying blood donors’ acceptance of DASSs.

2.1 | Conceptual model

Figure 1 shows an overview of the conceptual model. Based on the TAM logic, our conceptual model seeks to explain blood donors’ intentions to use the DASS (Davis, 1989). These intentions, together with individual perceptions of usefulness and the system’s ease of use, form the donors’ acceptance of the DASS. The model incorporates additional factors that we conceptualize as antecedents. We introduce one COVID-19 specific antecedent (compliance with COVID-19 health measures) and several antecedents that refer to service quality (planning convenience, improved communication, reduced flexibility, system deficiencies, enhanced donation experience). In the following, we describe each of these model components and develop our hypotheses regarding the causal relationships among them.

2.2 | Acceptance of DASS technology

According to the original TAM, technology acceptance means that users’ high-perceived usefulness and ease of use will lead to higher intentions to use a technology, and thus, will positively increase the subsequent usage behavior (Davis, 1989; Sharp, 2007; Venkatesh & Davis, 2000). We argue that this relationship is especially applicable for the blood donor population, compared to other users like patient populations, based on the following reasoning. The blood donation setting differs from other usage settings, because user motivation is different. Donors’ behaviors are rooted in special motivations, such as altruism, personal values, or psychological benefits like a warm glow.

FIGURE 1 Conceptual model of blood donors’ acceptance of a donation appointment-scheduling system (DASS). Source: Based on Venkatesh & Davis, 2000
(Bednall & Bove, 2011; Bekkers & Wiepking, 2011). Donors volunteer to donate; in contrast, patients seek care and support when engaging in health services. As Brown et al. (2002) showed, the mechanisms of technology acceptance are influenced by users’ dependence on the technology in question. It is therefore critical that blood donors perceive the DASS as useful so that they intend to use it to make their donation. Consequently, in blood donation, the donation process, including the DASS, must be as satisfactory for donors as possible to keep them loyal to donation (Melián-Alzola & Martín-Santana, 2020; Sargeant, 2001; Schreiber et al., 2006).

Hence, in the blood donation context, we argue that perceived usefulness and perceived ease of use are both direct predictors of blood donors’ intentions to use the DASS. In many studies, perceived usefulness has been shown to be a strong driver of intention to use technology (Legris et al., 2003; Ma & Liu, 2004; Sharp, 2007). Ease of use, in comparison, has a weaker, but significant, effect on usage intention in most studies (King & He, 2006). In their meta-analysis of 88 studies on the TAM, King and He (2006) found that both predictors together explain approximately 50% of the variance in behavioral intentions. These findings hold true in the context of appointment scheduling technology in healthcare (Kumar & Natarajan, 2020; Taufiq et al., 2020). We argue that this can be transferred to the blood donation context and, consequently, hypothesize:

**Hypothesis 1.** Perceived usefulness is positively related to intentions to use the DASS.

**Hypothesis 2.** Perceived ease of use is positively related to intentions to use the DASS.

Moreover, we include in our model the perceived ease of use of the DASS as a direct determinant of perceived usefulness (Davis, 1989; Venkatesh & Davis, 2000). This means that the easier a donor perceives the usage of the DASS, the more it will be regarded as a helpful tool for blood donation. Several studies on the acceptance of appointment-scheduling systems in the healthcare sector have provided empirical evidence for this relationship (Kumar & Natarajan, 2020; Rahimi et al., 2018). In the case of blood donation, we know from the example of mobile application technology that ease of use is a potential concern for donors (Yuan et al., 2016). Thus, we hypothesize:

**Hypothesis 3.** Perceived ease of use is positively related to the perceived usefulness of the DASS.

### 2.3 | Antecedents of blood donors’ acceptance

Several extensions were made to the original TAM to better describe the antecedents of the principal TAM components (Lee et al., 2003; Marangunic & Granić, 2015). The TAM2 model—an extension developed by Venkatesh and Davis (2000)—includes a set of antecedents that influence perceived usefulness.

#### 2.3.1 | Compliance

The TAM2 integrates social influence as an antecedent of perceived usefulness, which, in our model, is represented by the blood donor’s individual compliance with COVID-19 health measures, as we focus on the special COVID-19 context. Such health measures are, for example, the governmental contact-limitation rules, keeping 1.5 m from other people, using contact tracing applications, avoiding crowded places, and hygiene regulations. We argue, analogous to Venkatesh and Davis (2000), that this compliance behavior represents a form of subjective norms that drive the system’s perceived usefulness. The reasoning behind this is a process called internalization by which an individual incorporates the anticipated positive opinions about the technology in question held by important other people into their own belief systems (Venkatesh & Davis, 2000). People who comply with these measures make inferences about related activities that help further adhere to the rules supported by the community. Hence, we argue that people who felt a stronger need to comply with COVID-19 measures are also more likely to deem the DASS a useful tool because it distinctly helps them follow the contact limitation and distancing rules. Additionally, studies show that individuals who comply with COVID-19 rules are more worried about contracting the virus (Brouard et al., 2020; Harper et al., 2020). We argue that implementing a DASS will lead to reducing that fear and will, therefore, also be especially valued by compliant donors. As Leung and Lee (2020) explain, careful organization of donation appointments minimizes the risk of infection during a blood donation drive. By booking an appointment via a DASS, blood donors can be sure that the allowed number of persons per event will be realized by the blood donation service. Thus, we hypothesize:

**Hypothesis 4.** Compliance with COVID-19 health measures is positively related to perceived usefulness of the DASS.

Next to compliance, as in the TAM2 model, we include several cognitive instrumental antecedents of perceived usefulness of the DASS technology.

#### 2.3.2 | Service quality

As shown in Figure 1, we conceptualize a link between service quality and the system’s perceived usefulness. Venkatesh and Davis (2000) explain that, to some extent, users build their judgments about a system’s usefulness by cognitively evaluating the technology’s benefits in terms of what they want to accomplish in that particular usage context. For the DASS, we argue that blood donors form their opinions about the DASS’s usefulness by estimating what the technology can provide regarding service quality improvements. It is widely accepted in the literature that service quality, in its various manifestations, affects the service’s utility (Cronin Jr et al., 2000; Hu et al., 2009; Parasuraman et al., 1991; Zeithaml, 1988).
In blood donation research, studies distinguish the relevant aspects of service quality in different phases of the donation experience. According to Leipnitz (2014) p. 168, “the experienced service quality depends on various steps and interactions during the donation process.” The author distinguished the manifestations of service quality donors experience during a blood donation drive. Melián-Alzola and Martín-Santana (2020) first differentiated the aspects of service quality during the blood donation procedure, like short waiting time and sufficient attention by the staff, and second, in the post-donation phase, like receipt of thank-you letters. Regarding appointment-scheduling systems related to blood donation, we assume that their influence on service quality in the pre-donation and donation phases need to be considered. These perceptions influence the system’s evaluation as useful and thus drive acceptance of the DASS. In the pre-donation phase, (1) higher planning convenience and (2) improved communication between blood donors and blood donation services are positive service quality dimensions, while (3) reduced flexibility for donors, and (4) system deficiencies, such as error messages, are negative dimensions of service quality. Given donation, (5) an enhanced donation experience is important (Baş et al., 2018; GRC, 2021a).

Planning convenience
Hence, the first dimension of service quality that influences the perceived usefulness of the DASS in the pre-donation phase is the blood donor’s planning convenience. Studies have shown that blood donation convenience and successful planning are crucial for blood donors, and Schreiber et al. (2006) stated that inconvenience is a major barrier to donation. Van Dongen et al. (2014) identified that failure to plan their own blood donation diminishes donor retention. In the context of educational technology, Chang et al. (2012) proved that the more a user values the fact that a technology can be used any time and at any place, the higher its perceived usefulness. In the context of appointment scheduling systems, Paré et al. (2014) found that the ability to schedule appointments at a convenient moment is a valued benefit of such systems. Thus,

Hypothesis 5a. Planning convenience is positively related to the perceived usefulness of the DASS.

Improved communication
The second pre-donation dimension of service quality is improved communication. Sundermann et al. (2017) found that, in general, blood donors wish to be contacted digitally by blood donation services. Yuan et al. (2016) found that blood donors like to quickly receive a booking confirmation. Paré et al. (2014) stated that reminders sent through an appointment scheduling system are a feature that users value. Sundermann and Leipnitz (2019) also highlighted the importance of reminders in the context of blood donation. When highly automated, a DASS can facilitate communication by sending confirmations, reminders, information about changes, and calendar entries. Consistent with the TAM2 reasoning by Venkatesh and Davis (2000), we argue that blood donors who appreciate the DASS’s benefit in terms of communication with the blood donation service, will evaluate it as useful for blood donation. We hypothesize the following:

Hypothesis 5b. Improved communication with the blood donation service is positively related to the perceived usefulness of the DASS.

Reduced flexibility
The third pre-donation dimension, that is, potentially reduced flexibility, impairs service quality, and is therefore detrimental to the perceived usefulness of the DASS. In certain social groups, such as employees with dynamic working time patterns, individual blood donors’ flexibility can be restricted because an imposed DASS makes it necessary to determine a timeslot up front. In blood donation research, it is well known that a frequent deterrent to continued blood donations is the blood donors’ busy lives, which are filled with obligations, such as work, family, and hobbies (Bednall & Bove, 2011; Klinkenberg et al., 2018). For some busy donors, it might be stressful to determine and commit to a fixed date. Blood donors who feel that the DASS restricts their flexibility and makes blood donation more cumbersome will accordingly evaluate the DASS as less useful.

Hypothesis 5c. Reduced flexibility through the DASS is negatively related to its perceived usefulness.

System deficiencies
The fourth pre-donation dimension of service quality, which again hampers perceived usefulness, is system deficiencies, such as error messages or fully booked desired dates in the usage situation. Smooth performance of the DASS is important for gaining blood donors’ acceptance. In terms of self-service technology, previous studies have found that technology’s perceived performance and reliability impact users’ satisfaction and their attitudes toward it (Dabholkar & Bagozzi, 2002; Walker et al., 2002). For the pre-donation phase, we hypothesize the following:

Hypothesis 5d. System deficiencies are negatively related to the perceived usefulness of the DASS.

Enhanced donation experience
The fifth dimension of service quality that surfaces during donation is an enhanced donation experience associated with the DASS. According to the TAM2 reasoning, we argue that blood donors perceive the DASS as being useful if they feel that the tool supports them in being able to donate blood, precisely directly improving the experience at the blood drive. Melián-Alzola and Martín-Santana (2020) and Leipnitz (2014) highlighted the importance of a pleasant experience during the blood donation process. McKeever et al. (2006) found that prolonged queuing reduces donors’ satisfaction and deters future donations. Baş et al. (2018) state that appointment scheduling increases the quality of the blood donation process, for example, by reducing wait time or optimizing staffing. The blood donors’ experience during the donation process is of particular importance in a
to the Facebook posts, we roughly estimate that \( n = 350 \) respondents can be attributed to the social media mode of invitation. In total, 3269 blood donors from these two German regions completed the questionnaire.

Our target group includes donors with recent donation experiences. At a time when DASS was obligatory, this implies that most respondents had used the DASS prior to completing the survey. In our sample, \( n = 67 \) blood donors indicated that they did not use the DASS themselves, for example, because another person, like a staff member at the hotline, booked their appointment. Our sample does not include donors whose last donation was more than 6 months prior to data collection and who, therefore, may not have had contact with the DASS. We deem our sample suitable to find answers to our research question regarding how blood donors’ intentions to use the DASS can be maintained beyond the COVID-19 crisis.

During the data collection period in July and August 2021, German governmental infection prevention measures were based on local COVID-19 incidence rates with strict rules in high-incidence areas and more relaxed rules in low-incidence areas. It was widely required to keep 1.5 m distance from other people; wear face masks when using public transportation, at supermarkets, and in public places; follow hygiene protocols; and engage in contact tracing. Reducing contacts to a necessary minimum was recommended. Various kinds of services or cultural events began to be allowed again under the premise of showing proof of being tested, vaccinated, or convalescent from COVID-19. Depending on actual incidence rates, private gatherings could still be reduced to, in the strictest incidence-category, a maximum of five persons from two households.

The questionnaire included a request to consent to the data protection policies, information on prior DASS usage, sections of questions targeting the components of our framework, and questions on sociodemographic information and blood donation history. Table 1 shows an overview of all sample characteristics.

The sample’s age distribution approximated the overall blood donor population in the two German regions: 23.6% were under 35 years of age (compared to 28% according to the GRC reported age distribution in both regions combined), 44.3% were in the 35–54 age group (compared to 39%), and 32.1% were aged 55 years or older (compared to 33%). Most respondents (96.0%) had donated whole blood in the past, and 63.4% were employed full-time. A total of 22% had used the DASS once or twice to book a donation appointment, 48.3% had used it three or four times, and 27.7% had used it more than four times.

This study was conducted in accordance with the ethical standards of the authors’ university. It followed the data protection protocols of the GRC blood donation services and was discussed with those responsible for donor management.

### 3.2 Measurement

Our framework’s constructs were measured using multi-item scales, excluding two control variables (past donation frequency and age),
which were measured using a single item. For the multi-item scales, we mainly used validated scales from relevant studies, slightly changed the wording of items per construct to meet the blood donation context, and translated them into German. All measurement scales are presented in Appendix 1. In general, items were measured on a 7-point Likert scale ranging from 1 (totally disagree) to 7 (totally agree).

### 3.2.1 | Intention to use

The construct of intention to use the DASS was operationalized using the four-item scale for continuance intention devised by Chen et al. (2013). The authors based their scale on the original TAM2 intention scale (Venkatesh & Davis, 2000) but enriched the items with the idea of continuing usage rather than beginning it, which also fits our acceptance situation. This means that the respondents were asked, for example, “I intend to continue using the DASS regularly in the future” or “My intentions are to continue using the DASS instead of using any alternative means of appointment scheduling (e.g., via hotline or sign-in directly at the blood drive).” Note that because the DASS is relatively new, these old means of making appointments were still present in the blood donors’ minds.

### 3.2.2 | Perceived usefulness and ease of use

The scales of the constructs perceived usefulness and perceived ease of use were adopted from Hume’s (2015) study, which combines both into one construct. However, we measured them as two distinct constructs with four items each. Hume’s items are based on Davis’s (1989) original TAM items for both constructs but adapted to the nonprofit context. To capture perceived usefulness, respondents had, for example, to rate whether “using the DASS would enhance the effectiveness of my blood donation” or “using the DASS of my blood donation service would help improve my performance at donating blood.” For perceived ease of use of the system, they evaluated, for example, “it would be easy for me to become skillful with the DASS” or “learning to use the DASS was easy for me.”

### 3.2.3 | Compliance

Compliance with COVID-19 health measures was operationalized using eight items based on Brouard et al.’s (2020) compliance scale. To gain insight into compliance behavior in past DASS usage situations, we asked the respondents whether they had changed their behavior over the past months because of COVID-19 and the governmental virus-mitigation rules. The respondents had to rate how much they agreed with statements like “In the past months I avoided crowded places” or “… reduced my trips.”

### 3.2.4 | Service quality

To measure service quality, we used scales based on a review of the literature, which were further discussed with blood donation professionals to secure the validity of their contents. In the case of planning convenience, we borrowed Chang et al.’s (2012) scale, which was applied in their study to research the construct in the context of mobile technology for e-learning. The scale consists of four items, such as “The DASS makes it easier for me to book an appointment” or “I think using the DASS is convenient because I can book a blood donation appointment at any time.”

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**TABLE 1** Sample characteristics

| Variable                          | n   | (%)  |
|----------------------------------|-----|------|
| **Total**                        | 3269| 100.0% |
| Age (years)                      |     |      |
| <35                              | 772 | 23.6 |
| 35–54                            | 1447| 44.3 |
| > 55                             | 1050| 32.1 |
| Past blood donations (#)         |     |      |
| 1                                | 39  | 1.2  |
| 2–5                              | 538 | 16.5 |
| 6–10                             | 430 | 13.2 |
| 11–20                            | 617 | 18.9 |
| >20                              | 1645| 50.3 |
| Blood donation type              |     |      |
| Whole blood                      | 3137| 96.0 |
| Plasma                           | 27  | 0.8  |
| Thrombocytes                     | 4   | 0.1  |
| Various types of donations       | 101 | 3.1  |
| Time of last donation            |     |      |
| In past 6 months                 | 3130| 95.7 |
| Longer ago                       | 139 | 4.3  |
| Employment status                |     |      |
| Employed full-time               | 2071| 63.4 |
| Employed part-time               | 513 | 15.7 |
| Student/trainee                  | 226 | 6.9  |
| Pensioner                        | 342 | 10.5 |
| Homemaker                        | 51  | 1.6  |
| Unemployed                       | 21  | 0.6  |
| No answer                        | 45  | 1.4  |
| DASS usage (# in past)           |     |      |
| 1–2 times                        | 718 | 22.0 |
| 3–4 times                        | 1579| 48.3 |
| More than four-times             | 905 | 27.7 |
| Another person used it instead   | 67  | 2.0  |

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Improved communication through technology and appointment scheduling solutions was discussed by Paré et al. (2014) and
Sundermann et al. (2017), who introduced several items regarding communication between blood donors and blood donation services, such as online information and support. We asked the respondents three questions: whether they liked that “the DASS sends me reminders,” “sets up digital calendar entries,” or “if the donation site changes, I receive information via email or SMS.”

Reduced flexibility was derived from the questions of Klinkenberg et al. (2018) and Melián-Alzola and Martín-Santana (2020), who listed items about schedule convenience or obligations that restrict time for donating blood. Reduced flexibility, measured with three items, impairs service quality, and, therefore, is negatively connoted. We asked respondents, for example, if they find that the DASS is disadvantageous “because I cannot go for blood donation spontaneously” or “because combining blood donation with my other commitments is becoming difficult.”

Perceived system deficiencies were operationalized using three items inspired by questions on technical performance and reliability (Dabholkar & Bagozzi, 2002; Walker et al., 2002). Respondents had to rate whether they see reduced functionality at the DASS because “my favorite time-slots are often booked-out” or “the system often shows errors during the booking process.”

Regarding an enhanced donation experience, our five questions are based on items used by Leipnitz (2014) and Melián-Alzola and Martín-Santana (2020). The study participants had to evaluate whether they thought that the DASS improves the experience at a blood drive “because it reduces my unproductive wait time” or “because it minimizes the number of persons present” or “because I receive more attention from the personnel.”

3.2.5 | Controls

The control variable of perceived mandatory usage was measured using Venkatesh and Davis’s (2000) established three-item voluntariness scale, which was reversed to better fit the mandatory environment. The scale for experience with appointment scheduling systems was taken from Gefen et al. (2003). Past blood donation frequency, another control variable in our model, was operationalized using a single question about the number of times the participants had donated blood to GRC blood donation services.

3.3 | Data analysis

Besides descriptive analyses, we applied partial least squares structural equation modeling to analyze our data (Bayonne et al., 2020; Hair et al., 2012; Henseler et al., 2009). PLS-SEM is considered a standard method in marketing research to gain evidence of a model’s causal relationships (Hair et al., 2011). It is especially suitable for complex models and supports exploring extensions of theoretical models (Hair et al., 2019). Furthermore, it permits integrating formatively measured constructs. Applying the PLS-SEM technique typically requires a two-step procedure in which the measurement model is evaluated first (Step I) and the structural model second (Step II) (Sarstedt et al., 2017). We used the statistical software packages IBM SPSS Statistics version 26 and SmartPLS (version 3.3.2) to perform the calculations (Ringle et al., 2015).

4 | RESULTS

4.1 | Evaluation of the measurement model

To examine the causal relationships in our model, we followed the PLS-SEM procedure and evaluated the measurement and structural models. Our measurement model comprises one formative and several reflective operationalized constructs. Reflective operationalization can be defined as a scale in which a change in the underlying latent variable causes changes in the assigned indicator variables that are essentially interchangeable (Hair Jr et al., 2017). In reflective operationalization, the construct is a trait that explains the indicators. On the contrary, in a formative measurement, also known as an index, the construct is a combination of indicators. A change in one or more of the indicator variables causes a change in the latent variable. Different quality criteria were applied to evaluate these two types (Hair et al., 2019). Details of the quality criteria for all multi-item constructs are provided in Appendix 1.

First, we examined the dimensions of item and construct reliability in the reflective measurement model, as well as convergent and discriminant validity (Hair et al., 2019). Overall, the results suggest good quality reflective measures. Factor loadings, a score for the strength of the relationship between the indicator and underlying factor, for all but four items exceeded the recommended threshold value of 0.708, which indicates high-item reliability. The four items’ loadings are below this value, but their significance was verified using the bootstrapping procedure in all but two indicators for the control variable “mandatory usage.” We checked Cronbach’s alpha to evaluate construct reliability. All constructs achieved values above 0.60, which is considered acceptable in exploratory research (Diamantopoulos et al., 2012). To establish the convergent validity of the constructs, we evaluated the average variance extracted (AVE), which surpassed the threshold of 0.50 in all cases except “mandatory usage.” The AVE is the mean of the squared loadings of all indicators attached to the construct. Finally, we assessed the heterotrait-monotrait (HTMT) ratio to provide evidence for the constructs’ discriminant validity. All values lie below the suggested maximum threshold value of 0.85 (Henseler et al., 2015). These authors define the HTMT ratio as the average of all indicator correlations across different constructs in relation to the average of the correlations of indicators within one construct.

The assessment of the formative construct of compliance suggests weak quality. To assess convergent validity, we performed a redundancy analysis (Cheah et al., 2018). The correlation to the global measure exceeds the value of 0.60, but not the threshold of 0.70. This indicates that there may be other items relevant to the construct. To test for critical collinearity issues, we checked the variance inflation factor (VIF). Our results indicated that there were no collinearity issues, and all VIF values were below the maximum threshold of
5 (Hair et al., 2019). Finally, we examined the statistical significance of the indicator weights and outer loadings by applying the bootstrapping technique. We find that some items of the compliance construct do not reach significant weights. We decided to keep the construct derived from the literature as at least the outer loadings were significant.

Table 2 reports the means at the construct level; for detailed means at the item level, see Appendix 1. Construct means were calculated using the unstandardized latent variable scores obtained in the course of the PLS-SEM model estimation using the importance-performance map analysis (Ringle & Sarstedt, 2016). In general, we find high levels of acceptance regarding the DASS within our sample of blood donors. With a mean value of 6.11, intention to use the DASS is quite high (7-point Likert scale, 1 = “totally disagree” to 7 = “totally agree”). The respondents positively rate perceived usefulness (5.75) as well as perceived ease of use (6.37). Regarding the antecedent constructs, we find that compliance with COVID-19 health measures among the sample was high (6.06). Respondents on average attributed high-planning convenience (6.21) and improved communication with blood donation services (5.97) to the DASS and found that it enhances the donation experience (5.74). On average, the respondents find that the DASS does not reduce flexibility (2.93), and they did not experience system deficiencies (2.78). Although the mean value for reduced flexibility is rather low, the considerable standard deviation (1.95) indicates that some blood donors do not deem it completely beneficial because they cannot spontaneously go for donations. Despite the fact that the DASS has been mandatory since the pandemic’s beginning, the perception of the mandatory mode is not distinct (mean value 3.44). We find significant differences among the mean values of the two geographic areas Baden-Württemberg-Hessia and North-East (mainly federal states Saxony, Brandenburg, and Berlin). Acceptance values for the DASS were higher in Baden-Württemberg-Hessia and service quality perceptions were more favorable.

### 4.2 Evaluation of the structural model

To test the hypotheses, we assessed the structural model. As quality criteria, we considered the inner VIF values, which are acceptable (≤5), indicating no collinearity issues; the Q² value, which provides evidence on the model’s predictive accuracy based on a blindfolding procedure (Hair et al., 2019); and the coefficient of determination (R²). The Q² values exceeded the threshold of zero, indicating the predictive relevance of the path model. The height and significance of the path coefficients, which we obtained by bootstrapping, provide information regarding the hypotheses. In Table 3, we present the path coefficients, which can be interpreted as standardized beta coefficients of the ordinary least squares (OLS) regression, and the conclusions regarding the respective hypotheses.

In the case of the endogenous construct perceived usefulness, the antecedents explained 62% of the variance (R² = 0.616). The variance explained for intention to use the DASS was 63% (R² = 0.629).

Regarding the acceptance constructs at the model’s core, all hypotheses (H1, H2, H3) are supported by the results. The perceived usefulness of the DASS strongly influenced the intention to use it (0.632, p = 0.000). Perceived ease of use also had a significant effect on use intention (0.140, p = 0.000). We find a positive and significant path coefficient for the relationship between perceived ease of use and perceived usefulness (0.151, p = 0.000).

Regarding the antecedents of perceived usefulness, we find support for hypotheses H5a, H5b, H5c, and H5e. The strongest positive influence was exerted by perceived planning convenience, with a path coefficient of 0.337 (p = 0.000), followed by perceived enhanced donation experience (0.268, p = 0.000). Although small, the influence of perceived improved communication (0.063, p = 0.000) is positive and significant. A strong negative influence on perceived usefulness of the DASS exerts perceived reduced flexibility through the system, with a path coefficient of −0.200 (p = 0.000). The path coefficients for compliance with COVID-19 health measures (0.014, p = 0.275) and system deficiencies (0.020, p = 0.167) are extremely small and not significant; consequently, H4 and H5d must be rejected.

Regarding the control variables, general experience with appointment scheduling technology has, as assumed, a positive influence on intention to use the system (0.133, p = 0.000).

### 5 DISCUSSION AND IMPLICATIONS

#### 5.1 Research discussion

##### 5.1.1 Overall acceptance

Our study contributes to research on blood donors’ behaviors in the context of COVID-19, addressing the underrepresented issue of how
blood donors’ intentions to use online appointment-scheduling systems can be maintained beyond the COVID-19 crisis. With a sample of active blood donors who were likely to have had contact with the DASS because of its obligatory usage during the pandemic, we examined donors’ future usage intentions, perceived usefulness, and perceived ease of use. We identified factors that drive usage intentions and can be targeted with marketing activities. Since our sample did not include inactive users, we cannot make inferences about the overall acceptance distribution in the total donor population. However, the acceptance mechanisms that we hypothesize regarding the fundamentals of the TAM were largely confirmed with the sample.

### 5.1.2 | Acceptance of the DASS

In general, we find strong acceptance levels of the DASS among active blood donors at a time when contact-limitation laws are only marginally relaxed. This finding corresponds to reports within the emerging strand of literature on the so-called digital revolution through COVID-19, which is said to have elevated acceptance levels for various technologies in all areas of life (Brem et al., 2021; Dhawan, 2020; Hantrais et al., 2021). Brem et al. (2021,p. 5, underline that these shifts in behavior can be expected to outlive the pandemic and state that “the massive testing and diffusion of new technologies have led to leaps in knowledge, which makes them preferable to previous alternatives.” Our findings indicate that this statement is also applicable to blood donors’ behaviors. Concurrently, several recent studies in the broader non-profit relationship marketing domain confirm a general shift from the analogue to the digital world (Koksal et al., 2021; Lee & Ng, 2021; Olinski & Szamrowski, 2020).

Our results provide empirical evidence regarding the hypothesized relationships between the DASS’s perceived ease of use, perceived usefulness, and intention to use. We find that intentions to use the DASS are explained to a large degree by perceived usefulness and perceived ease of use, where the influence of perceived usefulness is the strongest. This is consistent with numerous studies on technology acceptance that underpin this association (King & He, 2006; Legris et al., 2003; Ma & Liu, 2004; Sharp, 2007). Consistent with these findings, our results also indicate that perceived ease of use influences the system's perceived usefulness.

### 5.1.3 | Antecedents of blood donors’ acceptance

Our study provides evidence regarding the drivers that significantly influence acceptance of the DASS. As we assumed, its acceptance is

| Hypotheses                                      | Path coefficients | SD  | H supported |
|-------------------------------------------------|-------------------|-----|-------------|
| Acceptance                                      |                   |     |             |
| H1: Perceived usefulness → intention to use     | 0.632***          | 0.017| Yes         |
| H2: Perceived ease of use → intention to use    | 0.140***          | 0.019| Yes         |
| H3: Perceived ease of use → perceived usefulness| 0.151***          | 0.019| Yes         |
| Antecedents of perceived usefulness             |                   |     |             |
| H4: Compliance health measures → perceived usefulness| 0.014 n.s.  | 0.013| No          |
| H5a: Planning convenience → perceived usefulness| 0.337***          | 0.023| Yes         |
| H5b: Improved communication → perceived usefulness| 0.063***          | 0.017| Yes         |
| H5c: Reduced flexibility → perceived usefulness | −0.200***         | 0.017| Yes         |
| H5d: System deficiencies → perceived usefulness | −0.020 n.s.       | 0.015| No          |
| H5e: Enhanced donation experience → perceived usefulness | 0.268***    | 0.019| Yes         |
| Controls                                        |                   |     |             |
| Perception of mandatory usage → intention to use| −0.038 n.s.       | 0.023|             |
| Experience appointment-scheduling systems →     | 0.133***          | 0.014|             |
| intention to use                               |                   |     |             |
| Age → intention to use                         | −0.026*           | 0.012|             |
| Donation frequency → intention to use           | −0.022*           | 0.011|             |
| Endogenous constructs                          | R²                | Q²  |             |
| Perceived usefulness                           | 0.616             | 0.474|             |
| Intention to use                               | 0.629             | 0.491|             |

Note: SmartPLS bootstrapping settings: 5000 iterations; N = 3269.
Abbreviation: n.s., not significant.
*p < 0.05; **p < 0.01; ***p < 0.001.
facilitated by different aspects of perceived changes in service quality due to the system. More precisely, the perceived usefulness of the DASS is well explained by four dimensions of service quality in the pre-donation phase and during the donation. The strongest influence related to the pre-donation phase is planning convenience from the donor's perspective. This is consistent with other studies that also find this facet of service quality improves acceptance of appointment scheduling systems (Chang et al., 2012; Paré et al., 2014). Furthermore, we find a small influence of improved communication prior to the donation. This effect is congruent with other works in blood donation research that highlight donors' desire for more customized, digital communications with the donation service (Sundermann et al., 2017; Yuan et al., 2016). As expected, we find an individual's perceived reduced flexibility as a result of the system has a strong diminishing effect on DASS acceptance. Scholars and practitioners acknowledge the need for flexible donation possibilities that fit busy lifestyles (Öhrner et al., 2019). With the DASS, an appointment must often be booked days in advance. Accordingly, people who think the DASS reduced their flexibility perceive it as less beneficial. Regarding service quality during the donation, we find the enhanced donation experience as a result of the system strongly influences its acceptance. The more a blood donor acknowledges improvements in the donation procedure due to the DASS, such as reduced wait time, the more they will appreciate the system. This result is consistent with prior research on the importance of service quality during the blood donation process (Boenigk & Helmig, 2013; Leipnitz, 2014; Melián-Alzola & Martín-Santana, 2020) and the process benefits that a DASS is known to bring (Baş et al., 2018).

We did not find evidence that a person's compliance with COVID-19 health measures influences the perceived usefulness of the DASS. This suggests that on the one hand, during the pandemic, donors learned to trust that blood donation services protect their donors and minimize the danger of infection, for instance, with further onsite hygiene and distancing protocols. As Masser et al. (2020) show, this trust has diminishing effects on a perceived threat. If the threat is averted, the blood donor's compliance with health measures no longer explains appreciation of the DASS. GRC Blood Donor Service Baden-Württemberg-Hessia and North-East had already established several measures in the pandemic's early phase, such as the rule to keep 1.5 m distance from fellow donors and staff, hygiene regulations like disinfection stations, or an intense pre-assessment of risk factors prior to arrival at the donation site. On the other hand, our findings indicate that donors who exhibit low compliance to public health measures for COVID-19, do not evaluate the system, which was a virus mitigation measure in the first place, systematically as less useful. The model's results suggest that service quality benefits of the system dominate. The findings of this study support the assumption that blood donors, after having used the system and had their first experiences, evaluate it much more in terms of service quality improvements. For those donors who do not comply with the general COVID-19 rules, their judgments on aspects like perceived planning convenience or reduced waiting times and crowding at the donation site were decisive for their opinion on the usefulness of the DASS. It follows that after the initial contact, the system is not regarded as merely another bothersome COVID-19 measure.

5.2 Managerial implications

To secure even higher levels of acceptance and prevent potential declines later, our findings indicate that blood donation services have different leverage points. Before the pandemic, the GRC blood donation services Baden-Württemberg-Hessia and North-East promoted the DASS with low-marketing pressure to build awareness and induce usage. The pandemic fundamentally shifted the situation. Capitalizing on the effects of the pandemic, awareness and usage of the system were boosted tremendously. The findings of this study outline certain areas for more specific marketing activities. The GRC and other blood donation services that experienced the same no longer need to use their marketing resources for basic awareness building. Now, resources can be used in a much more directed manner.

We formulate the following three strategic options:

1. Service quality strategy. Based on our finding that different service quality perceptions drive acceptance, we recommend that blood donation services use scheduling information to further improve service quality throughout the donation process. Examples are timely notification of deferral reasons through the system to avoid vain visits at the blood drive, the option to cancel appointments, or waitlists and invitations that are responsive to booking rates. Additionally, these benefits should be highlighted in marketing communications through content regarding donors' planning convenience and the enhanced donation experience, especially through reduced unproductive wait time and greater staff attention at the blood donation site. Besides donor benefits, such communication could also include an explanation of the benefits of the shared goal, that is, maintaining the blood supply at times when the donor base shrinks and donation services have to find solutions to efficiently meet the demand for blood.

2. Utilization training strategy. As perceived ease of use drives the usefulness of and intention to use the system, marketing communication should educate less technology-savvy donor groups, such as through system demonstrations during wait periods at blood donation sites. For example, the GRC Blood Donation Services Baden-Württemberg-Hessia and North-East produced a training video and shared it using the video platform YouTube (GRC, 2021b). Blood donors who are unable to use the technology themselves should be invited to call an appointment-service hotline to schedule a timeslot for their donation to further reduce the rate of donors who show up without an appointment.

3. Target group marketing strategy: Flexibility features for busy people. Based on the finding that flexibility needs diminish acceptance of the DASS and a considerable share of donors indicate such needs, we recommend specifically addressing this target group. While for most donors, planning convenience or planning security outweighs flexibility needs, donors with such needs show reduced intentions...
to use the system. As Zhou et al. (2012) state, segmentation and subsequent targeting is one means of addressing specific needs and thereby creating distinct values for subgroups. For example, features can be provided within the system, such as special contingencies for spontaneous bookings, or offering a few broader timeslots. Another option is to introduce special “drop-in only” donation events with exceptional character, whose promotions are distinct from the normal blood drives facilitated by the DASS.

5.3 | Limitations and future research

This study has limitations that provide directions for future research. The first limitation we acknowledge lies in our study’s sample of blood donors who were active during the pandemic. We think that these people are suitable choices to deliver insights on the drivers of acceptance. However, to find answers on the potential barriers to acceptance of the DASS from blood donors who were inactive during the pandemic requires more research. Future research needs to address whether aversion against COVID-19 measures like the DASS lead to a loss of donors. Furthermore, more information is needed on how or for whom an aversion against such measures interfered with other intrinsic motivations to donate. Furthermore, to reach less technology-savvy donors, different survey methodology is advisable since an online survey might not reach persons who have difficulty using technology.

Second, we investigated a context in which the DASS was not used before the COVID-19 pandemic and was then made mandatory. We acknowledge that in other countries and blood donation regimes, appointment scheduling systems might well have been used in the years prior to the current pandemic and prevailed under mandatory or voluntary usage modes. These could be included in future studies on long-term acceptance in different mandatory or voluntary usage environments by applying longitudinal designs.

The third limitation is that we worked with a single-source measurement design, which is known to potentially bias results owing to common method variance (Podsakoff & Organ, 1986). To address this problem, we evaluated the VIFs at the construct level that were below the critical value of 3.3, which, after Kock (2015), provides evidence that the model can be considered free of common method bias. Future research could rely on data sets retrieved from the databases of blood donation services to estimate real changes in behavior.

Fourth, we used constructs to measure service quality dimensions that do not rely on pre-validated scales. Future research is needed on the relationship between service quality and technology acceptance. We hope that this study inspires other researchers to initiate new research projects on blood donor behavior under COVID-19 and beyond.

The data that support the findings of this study are available from the authors upon reasonable request but are not publicly available due to protection requirements of the GRC blood donation services.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from German Red Cross Blood Donation Services (BaWu-He & NE). Restrictions apply to the availability of these data, which were used under license for this study. Data are available from the author(s) with the permission of German Red Cross Blood Donation Services (BaWu-He & NE).

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