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Declarations of interest: none

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1. Background

In hospitals, physicians often work under time pressure. A vivid example is the COVID-19 pandemic in which they were many times faced with overall time pressure during their workday as they had more patients to treat given an often insufficient number of physicians and healthcare professionals and additional tasks including documentation, and/or putting on protective gear.[1,2,3] The issue of physicians working under time pressure will most likely continue to play a decisive role in the coming years. Reasons contributing to such working conditions include a shortage in labour supply[4,5] as well as an expected increase in the demand in health care due to an ageing population that needs more care towards the end of life (e.g. references 6-8). The increasing time pressure in hospitals also poses major challenges for healthcare policy, especially when it comes to reconciling the quality of patient care with the often simultaneously increasing administrative documentation work.

Existing evidence on the working conditions of health care professionals including physicians and medical staff, such as increased workload and time pressure, shows that the latter has a negative impact on the quality of care (incl. treatment quality)[9-13] as well as on the quality of documentation (defined as diligence in proper documentation of diagnosis and treatment for reimbursement purposes), which in turn has a negative impact on hospital reimbursement.[14] Although data on procedures or diagnostics might be available and comparable to clinical guidelines, it is challenging to measure physicians' actual treatment quality in the field. Treatment quality measured for instance by the ex-post discharge mortality rate, is potentially influenced by many other confounders. It is also difficult to separate the effects of time pressure (workload) on treatment quality and documentation, as quality may be inadequately documented and recorded.

While evidence from workplace related laboratory experiments have shown that decisions made under time pressure reduce the quality of performance (e.g. references 15-18), less is known about how time pressure affects the provision and documentation behaviour of physicians. Particularly, little is known about the drivers of potential quality changes under time pressure. One explanation is that physicians could change their behavior due to more intentional choices under time pressure. This argument refers to the dual-system theory,[19,20] which assumes that decisions result from the interaction between two cognitive processes, the fast and intuitive one as well as the slow and deliberate one. Since physicians tend to be more intrinsically or pro-socially motivated toward their patients than the average employee,[21-24] time pressure could lead to more intentional decisions that influence physicians' altruism and hence patient

outcomes. However, a meta-study on 22 experimental studies by Fromell et al.[25] suggests that there is little support on the effect of intention, e.g. triggered by time pressure, on altruism. An alternative explanation is the concept of the speed-accuracy trade-off[26], which refers to the principle that increasing the speed of a decision often leads to a reduction in accuracy, and conversely, prioritizing accuracy tends to slow down responses. In terms of physiology, this trade-off is a fundamental element of cognitive and motor performance, as the individual must find a balance between speed and accuracy depending on the specific demands of a task. Accordingly, time pressure might come at the cost of lower accuracy in the form of more mistakes made by physicians treating patients and documenting their treatment efforts. Evidence from laboratory experiments trying to disentangle the two sources of behaviour change due to time pressure in risky decisions points towards the latter explanation: with time pressure the choice consistency or accuracy decreased, while preferences did not.[27,28]

The aim of our study is to explore the links between time pressure, additional documentation efforts, and treatment and using a stylized experiment. Medical students in the role of hospital physicians have to treat patients given a simplified Diagnosis Related Groups remuneration. In line with previous health economic experiments studying physician provision behaviour (e.g. references 29-36, patients are not present in the laboratory. Yet, their benefit in monetary terms goes to actual patients outside the laboratory. We implement an across-subject design and vary whether physicians are faced with time pressure, documentation tasks or both combined. This allows investigating the causal impacts of time pressure and additional documentation tasks on treatment and documentation quality. Similar to Kocher et al.[17] and Oxholm et al.[37], we also investigate whether an exogenous measure work motivation orientation according to the Amabile[38] is associated with heterogeneous responses to time pressure. We further explore potential drivers and consequences of changes in treatment quality. A better understanding of these aspects can support the idea of promoting new technologies that facilitate treatment decisions for physicians and support their documentation work, e.g. through the use of tools with artificial intelligence (AI), thereby reducing time pressure.

2. Methods

To study the effects of documentation and time pressure on physician provision and documentation behaviour, we implemented a between-subject design with a medical framing inspired by Brosig-Koch et al.[30-33]

2.1. Decision Situation

The basic decision situation employed in all experimental conditions is similar to the basic design in Brosig-Koch et al.[30-33]. We, however, focus on physicians working in hospitals and assume for simplicity that physicians are (perfect) agents of the hospital. Each participant i decides in the role of a hospital physician on the quantity of medical services $q = \{1, \dots, 11\}$. The chosen quantity determines the physician's profit π_{kl}^{i} as well as the patient's health benefit B_{kl}. Participants are confronted with a heterogeneous patient population consisting of ten different patients. The latter systematically vary the potential type of diseases $k \in [A, B, C, D, E]$, of which each can occur with a different severity $l \in [x, y]$, where x corresponds to a mild, and y corresponds to high severity. We thus deviate slightly from the original Brosig-Koch et al.[30-33] design of the patient utility functions with three severity levels and diseases. By increasing the variation in maximum patient benefit, we also ensure that the hospital setting is better represented, as patients can be heterogeneous in terms of their disease severity and hence the extent to which they benefit from a unit of treatment, e.g. one hour. The severity of a disease determines the patient optimal quantity of medical services q_l^* with $q_x^* = 3$ and $q_y^* = 9$. In line with Brosig-Koch et al.[30-33], the implemented diseases and severity levels imply a concave patient utility function that has been widely assumed in theoretical research[39-41] (see Appendix A.1 and Figure A.1.1 and Table A.1.1 there for a more detailed formal description). The monetary equivalent of the patient benefit resulting from a participant's choice of the quantity of medical services is transferred to real patients outside the laboratory.

A physician's profit π_{kl}^{i} is determined by the remuneration R and the costs c of treating a patient. The remuneration a physician receives for treating a patient is a lump-sum payment per patient which depends on the quantity of medical services provided R_l with $R(q \in 1, \dots 5) = 45$ and $R(q \in 6, \dots, 11) = 58.5$. We opted for a lump-sum payment, as this is the standard payment for hospitals in many OECD countries, i.e. the DRG (Diagnosis Related Groups) payment system.[39] We apply the basic DRG reimbursement mechanism in our design in the sense that the lump sum reimbursement is higher when higher quantities 6-11 are chosen, i.e. when a higher number of medical services are provided to a patient who is in need of more treatment. Although this offers the possibility to upcode as in Hennig-Schmidt et al.[43] and Groß et al.[44], we do not implement an audit mechanism for the sake of simplicity. Hence, upcoding cannot be observed. A physician also faces costs c when treating a patient. They are composed of a fixed component and one that depends on the quantity of medical services and are given by a convex cost function as in other theoretical models[40-41] The overall profit maximizing

quantity of medical services is given by $\hat{q} = 6$. For the high severity patient the physician needs to underprovide 3 quantities of medical services less than the patient optimal quantity to receive the overall maximum profit. For the low severity patient a physician needs to overprovide 3 quantities of medical services to receive the overall maximum profit. Since the patient benefit functions are symmetric, the effect of over- or underprovision of 3 quantities of medical services on patient benefit is the same. (see Appendix A.1 and Figure A.1.2 and Table A.1.1 there for a more detailed formal description).

Screenshots of the instructions provided to participants and decisions they had to make, as well as a description of the experimental procedure can be found in Appendix A.2 and A.4 respectively.

At the end of the experiment, participants also answered a questionnaire which included basic personal characteristics like gender, field of study, personality traits, and work motivation according to Amabile[38]. The Amabile work motivation questionnaire measures two types of motivation relevant to creativity and motivation in the workplace creativity: intrinsic (how engaging, challenging, personally rewarding or meaningful work is) and extrinsic (how external incentives, like money, influence work effort) motivation.

2.2. Experimental Conditions

To investigate the effects of documentation and time pressure on both physician provision behaviour and documentation quality, we implemented a series of combined experimental conditions using an across-subject design (see Table 1 for an overview and Appendix A.3 for additional details). In order to increase the external validity[45] of our study, we employed medical students as experimental subjects in our study. We thereby follow a large strand of economic experiments using medical students to investigate physician provision behaviour.[46-50]

To ensure comparability across all experimental conditions, we employed the same profit functions and the same patient population. In our Baseline (B) condition participants in the role of hospital physicians treat each of the ten patients sequentially. The order of the patients had previously been randomly determined and remained constant across all conditions. While this may result in order effects, we cannot control for, it comes at the advantage that the sequence is the same across all conditions. In the Documentation (DOC) condition we implemented a slider real effort task[51] to mimic physician documentation efforts. This is a computerized instrument used in economics to measure effort, productivity, and attention.

Participants repeatedly adjust sliders (e.g., from 0 to 100) to precise positions, requiring time, concentration, and accuracy. While seemingly unrelated, this task parallels physician documentation work in hospitals. Both involve repetitive, cognitively demanding tasks requiring high attention to detail: adjusting sliders e.g. mirrors filling out patient notes or entering precise data into electronic health records. Errors in either can have serious consequences, such as inaccuracies in medical notes impacting patient care and hospital remuneration. Moreover, participants in the slider task often feel their efforts lack meaningful outcomes, much like physicians who view documentation as a burden that takes time from patient care. Finally, both tasks produce measurable outcomes: the slider task quantifies effort through slider accuracy and completion time, while physician documentation is assessed through metrics like completed patient notes, time spent on records, and data accuracy. In the experiment, physicians were informed that they had to document their work by moving one slider per quantity of chosen medical service subsequent to each treatment decision. Choosing a higher quantity of medical services thus implied a higher workload. Relatively to our Baseline condition (B) this could have thus reduced their motivation to treat patients, particularly severe ones. Moving a slider to a given point was not additionally remunerated and thus if conducted by the participants additional voluntary workload. This was evident to participants from the instructions and stated again when doing the slider task. Hence, moving a slider to the correct point signals high work ethics. In the Time (TI) condition the physician faces a previously calibrated time restriction of 30 seconds per patient for the treatment decision. In case no decision was taken within this time limit, a quantity of medical treatment was randomly chosen at the end of the experiment. Our Time Documentation (TI_DOC) condition combines time pressure and work documentation efforts. Here, participants had a total of 60 seconds for both the treatment and documentation of one patient. Hence, in the time pressure treatments participants/physicians face a certain time limit which leads to less time for treating patients hence increasing the workload. Finally, we added treatments check for the robustness of our study design with regard to possible averaging effects (TI_DOC_C) and sequence of patients (TI_S_C) related to the time pressure (for additional details see Appendix A.3).

Alongside other personal characteristics, we elicited work motivation according to the work preference inventory (WPI) for college students by Amabile[38] in an ex-post questionnaire. The fundamental elements of the WPI include intrinsic (self-determination, competence, task involvement, curiosity, enjoyment, and interest) and extrinsic work motivations (concerns with competition, evaluation, recognition, money or other tangible incentives, and constraints by

others). Similar to Kocher et al.[17] this allows us to investigate whether physicians with different work motivations have heterogeneous responses to time pressure and documentation efforts.

Table 1: Experimental Conditions Overview

Condition	Time Pressure	Documentation Efforts	Separate Time Limits	Different Patient Sequence	# of Medical Students
Baseline (B)	-	-	-	-	43
Documentation (DOC)	-	X	-	-	25
Time (TI)	X	-	-	-	21
Time Documentation (TI_DOC)	X	X	-	-	30
Time Documentation Control (TI_DOC_C)	X	X	X	-	20
Time Sequence Control (TI_S_C)	X	-	-	X	24
Total					163

Notes: In TI_DOC we used one joint timer of 60 seconds for both the decision on the quantity of medical services and the documentation slider task. In contrast, in the Time Documentation Control (TI_DOC_C) condition we included a separate timer of 30 seconds for the treatment decision and another timer of 30 seconds for the slider task.

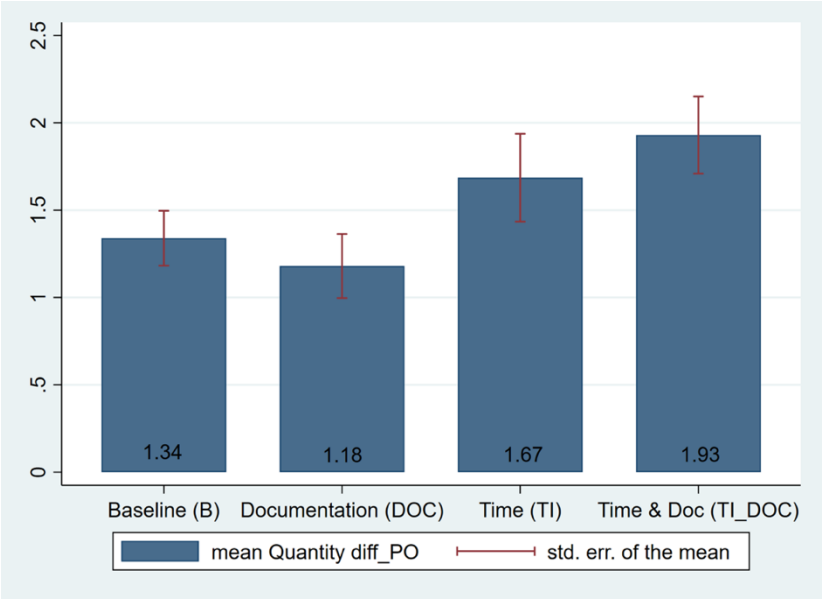
3. Results

3.1. Effects of Documentation and Time Pressure on Physician Provision Behavior

In this section, we aim to investigate the effects of time pressure and documentation on physician provision behaviour. To this end, we first consider the aggregate treatment decisions over all patients made by the participating medical students in the role of hospital physicians in the documentation treatment (DOC), the time treatment (TI), and the time documentation treatment (TI_DOC) and each compare them to the baseline treatment (B). Similar to the Brosig-Koch et al.[33], we introduce a measure of treatment quality: the (absolute) difference between the patient optimal (PO) quantity and actual treatment quantity provided. The average treatment quality thus ranges from 0, i.e., no deviation and optimal treatment quality, to 8, i.e., the largest deviation possible across all patients. Given our symmetric design of the patient benefit functions this measure of quality equally accounts for over- and underprovision of medical services and thus facilitates aggregation across all patients. Descriptive statistics for the average quantities of medical services provided by patient and by severity for each treatment can be found in Appendix B.1. Figure 1 illustrates the aggregated average treatment quality provided by

physicians by treatment condition. We find that physicians deviate on average by 1.34 units of treatment quantity from the patient optimal quantity 1.18 in DOC, 1.67 in TI, and 1.93 in TI_DOC.

Figure 1: Average Absolute Differences to PO Quantity by Treatment Condition



Notes: The bar graph shows average absolute differences to patient-optimal quantity by treatment condition. The blue bar is the average absolute difference indicating less treatment quality the higher it is. The lines indicate the standard error of the mean showing the variance for each treatment.

In order to estimate the effects of our experimental conditions on treatment quality, we employ mixed-models with random effects accounting for potential intra-individual correlation (see Table 2).[52,53] From Model 1 in Table 2 one can infer that neither additional documentation efforts nor time pressure have a significant effect on treatment quality. However, when time documentation efforts and time pressure are combined the deviation to the PO quantity significantly increases, i.e., treatment quality significantly decreases. The negative impact of the time documentation treatment (TI_DOC) on treatment quality is robust to all model specifications when controlling for other potential confounding variables such as gender. We also do not find support for this effect being driven by individuals transferring time from the treatment task to the documentation task in TI_DOC, since the average duration is not statistically to the TI condition (Wilcoxon rank sum test, TI vs. TI_DOC p=0.077).

Table 2: Effects on Treatment Quality

Model	(1)	(2)	(3)	(4)	(5)
Dependent variable:	Treatment Quality	Treatment Quality	Treatment Quality	Treatment Quality	Treatment Quality
DOC	-0.160	-0.160	-0.427	-0.216	-0.484*
	(0.234)	(0.234)	(0.264)	(0.231)	(0.261)
TI	0.346	0.346	0.119	0.396	0.168
	(0.248)	(0.248)	(0.279)	(0.252)	(0.282)
TI_DOC	0.590***	0.590***	0.745***	0.567***	0.721***
	(0.222)	(0.222)	(0.250)	(0.217)	(0.245)
Severity (high=1)		-0.397***	-0.512***		-0.512***
		(0.089)	(0.147)		(0.147)
Severity X DOC			0.536**		0.536**
			(0.242)		(0.242)
Severity X TI			0.454*		0.454*
			(0.257)		(0.257)
Severity X TI_DOC			-0.308		-0.308
			(0.229)		(0.229)
Gender (male=1)				-0.102	-0.102
				(0.180)	(0.180)
Age				-0.0352	-0.0352
				(0.0406)	(0.0406)
Risk				0.0972	0.0972
				(0.0639)	(0.0639)
Amabile_Intrinsic				0.0731	0.0731
				(0.240)	(0.240)
Amabile_Extrinsic				0.520**	0.520**
				(0.236)	(0.236)
Constant	1.340***	1.538***	1.595***	0.237	0.493
	(0.142)	(0.149)	(0.160)	(1.448)	(1.450)
Obs.	1,190	1,190	1,190	1,190	1,190
N	119	119	119	119	119

Notes: The table shows mixed-models with random effects accounting for potential intra-individual correlation (standard errors clustered at individual level). The dependent variable Treatment Quality is defined by the absolute difference to the patient optimal quantity. Risk preferences were elicited using the questions from Dohmen et al. (2011)[54], which assess individuals' willingness to take risks across various domains. The control treatments were excluded from the regression as we did not find any statistically significant differences and hence the number of observations is lower than the total number of observations. **** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.*

Model 2 of Table 2 further shows that a higher severity leads to a significant increase in average treatment quality, i.e., a lower average deviation the patient optimal quantity. The effect is robust across all model specifications. Model 3 of Table 2 shows interaction effects with experimental conditions. We find that more severely ill patients suffer relatively more from the introduction of additional documentation tasks. This may be the case as severely ill patients require more documentation efforts when treated well beforehand. The effect for the introduction of time pressure goes towards the same direction. However, it is only significant at the 10% level. The effect then disappears when time pressure is combined with additional documentation efforts. In an analogous analysis for the disease of illness we show that treatment quality is significantly higher for the diseases D and E which have the relatively high patient benefit across all treatment conditions (see Appendix B.2.).

Controlling for other factors such as gender, age, risk preferences, and intrinsic or extrinsic work motivation elicited in the ex-post experimental questionnaire (see Model 5 in Tables 2 and B.2.1 in Appendix B.2), our results remain robust. Furthermore, neither gender nor intrinsic motivation have any impact on treatment quality. We, however, find that participants who are more motivated by extrinsic factors such as their remuneration deviate significantly more from the patient optimal quantity as participants with less extrinsic motivation. We now also find a higher treatment quality in DOC which is significant at the 10% level. A potential explanation for the direction of this effect is that the documentation is perceived as some form of control or self-validation of choices. Results from the regression models of two additional control treatments conditions show that neither the patient sequence nor the design of the timer significantly affect treatment quality (see Table B.2.2 in Appendix B.2).

Further, we investigate whether the speed-accuracy trade-off, where less time for decisions is associated with more decision errors or reduced consistency[26], can explain changes in treatment quality. This should be evident by a larger variance in the average quality in conditions with time pressure than without, TI_DOC compared to DOC. A Levene test shows that the reduction in average quality from DOC to TI_DOC is associated with a higher variance, i.e., the latter is significantly higher in TI_DOC than in DOC ($p<0.001$). This supports the explanation that participants make more mistakes under time pressure and documentation than under documentation only and relates to the recent results by Olschewski and Rieskamp[27], who find that time pressure decreased choice consistency in risk decisions but not their preferences towards risk per se.

3.2. Effects of Time Pressure on Documentation Behaviour

In this section, we analyze how time pressure affects documentation behaviour. In the experiment the implemented slider task resembles the documentation of previously provided medical services. Per quantity provided one slider has to be moved correctly. We did not use a monetary incentive for the documentation task. Hence, any sliders moved reveal some form of intrinsic motivation to complete the task. We measure documentation quality as the percentage of sliders moved correctly per patient and aggregate by calculating the average across all patients (e.g. if a participant chose quantity 4 and moves 3 of the 4 sliders correctly, the documentation quality for this patient would be 75%). Across all patients we find that documentation quality is 94% in the documentation treatment (DOC) and 63% in the time documentation (TI_DOC). Possible explanations for the unexpectedly high documentation quality include the experimenter demand effect or a high work ethic of the participants.

A linear probability mixed-models regression confirms that time pressure significantly reduces documentation quality (see Model 1 in Table B.3.1 in Appendix B.3). Moreover, documentation quality is significantly lower for more severely ill patients for whom more documentation tasks need to be completed (see Model 2 in Table B.3.1 in Appendix B.3). The effects are robust towards controlling for other factors such as gender and intrinsic or extrinsic work motivation elicited in the ex-post experimental questionnaire. Interestingly, the more extrinsically motivated participants are, the higher the proportion of the correctly moved sliders. This supports the previous explanation that medical students in the role of physicians are aware that in practice documentation quality is crucial for a hospital to receive reimbursement and transfer this professional attitude to the experimental setting even if it does not include an actual hospital.

To further investigate the aspect that inaccurate documentation might lead to a profit loss for the hospital, we calculate the hypothetical profit loss for the hospital due to inaccurate documentation, i.e., the loss a hospital would bear if it could only charge the documented and not all provided aspects. For this, we calculate the average documentation accuracy, i.e., the number of correctly moved sliders divided by the total number of sliders to be moved per patient case. This bears the advantage of comparability of documentation accuracy across all patient cases. With this measure, we can then calculate the profit loss, i.e., the total profit with complete (100%) documentation minus the hypothetical profit due to inaccurate documentation, accuracy (e.g., 80%) times the total profit with complete documentation. Across all patients we find that the average percentage profit loss, i.e., the profit loss divided by the total profit with completely

correct documentation is 1% in the documentation treatment (DOC) and 19% in the time documentation (TI_DOC). With time pressure (TI_DOC) the hypothetical profit loss is statistically significantly higher than for the documentation treatment (DOC) ($p<0.01$, proportion test). In terms of monetary values, the hypothetical profit loss in the documentation treatment (DOC) is €2.28 while it is €60.23 with time pressure (TI_DOC). Hence, we can confirm the results of Powell et al.[14] in that time pressure might have a negative impact on hospital reimbursement.

4. Discussion

With this study, we make an important contribution to a better understanding of the relationship between medical treatment decisions under time pressure, documentation efforts and the resulting quality of treatment and documentation. For this, we use a laboratory experiment with medical students in the role of hospital physicians. While the measure of treatment quality from using field data is potentially influenced by many other confounders and may not allow to investigate potential drivers of quality changes, our parsimonious experimental design allows to show a direct effect of workload on physician behaviour and the resulting changes in treatment and documentation quality.

Our study thus contributes to the growing literature on experiments in health economics[35,55-57] that focus on examining the provision behaviour of physicians of medical services (see e.g. references 29-35, 46, 58-65). It particularly relates to the strand within this literature investigating the allocation of health care resources.[49,66-70] While these studies primarily focus on the effects of financial resource constraints on physician allocation behavior, the aim of our study is to explore the effects of time constraints and additional documentation tasks, on treatment and documentation quality. Our results show that increased time pressure and documentation efforts lead to lower treatment quality. This is in line with field evidence on increased workload or work pressure in the inpatient care setting, which finds that the latter leads to an acceleration in the service rate[11], is associated with an early discharge of patients[11,71], which is in turn correlated with a higher mortality rate[11]. Furthermore, it confirms results by Allen et al.[13] as they show in the outpatient care setting general practitioners are less compliant to clinical guidelines in the form of a substantial increase of broad-band antibiotic prescriptions.

Given the design of our study, we are also able to show that the change in treatment quality might be driven by the concept of the speed-accuracy trade-off. Moreover, we find that the reduction in quality might also be explained by an individual's work motivation: The

reduction in treatment quality is stronger for individuals whose individual extrinsic work motivation orientation according to the Amabile[38] questionnaire was higher. These results correspond to the evidence by survey studies that show that high workload as well as time pressure are aspects that seem to negatively impact physicians´ work motivation.[72-75]

Finally, we show that documentation quality is rather high even without monetary incentives to complete the task. With additional time pressure documentation quality is significantly reduced leading to a higher potential profit loss for the hospital. This result contributes to the finding that physicians do not properly document under high workload leading to a negative impact on hospital reimbursement.

Overall, we hence show that time pressure plays a substantial role in physician provision and documentation behaviour and its societal consequences. Policy reforms aimed at improving the treatment quality and reducing inefficiencies due to incorrect documentation should take this aspect into account. While policymakers in recent years have focused on designing financial incentives for physicians, particularly performance pay incentives, to increase treatment quality, their results have been relatively modest (see, e.g., reference 76 for a survey). Our results suggest that an alternative channel to increase treatment quality might be to use money to offer more resources to increase the staffing level of health care workers. They also support the notion of implementing standardized processes and guidelines as well as new technologies that reduce time pressure by facilitating treatment decisions and/or supporting documentation efforts. For treatment decisions, Artificial Intelligence (AI) assisted tools like clinical decision support systems and wearable devices provide real-time patient data, may help physicians to make faster and more accurate decisions. Furthermore, trainings for physicians to follow standardized processes and guidelines[77] and on how to use the aforementioned technologies effectively may reduce time pressure. For documentation, tools with integrated AI like speech recognition software and digital assistants may save time by automating note-taking and administrative tasks. Electronic health records with error-checking features and automated coding systems may moreover improve documentation accuracy and reduce manual input. Together, these innovations may enhance efficiency, allowing physicians to focus more on patient care.

Our study also has some limitations. The first limitation refers to the external validity. Using a laboratory experiment with medical students our results may be limited with regards to their external validity. However, a controlled laboratory experiment has high internal validity and may therefore serve as a complement rather than a substitute for other research methods

with high external validity. Our study design may be regarded as a 'wind tunnel study'[56], which may allow future research to investigate which policy measure may have an effect on alleviating the effects of treatment decisions under stress before implementing such elements for instance in a large-scale randomized controlled trials, or before introducing policy measures in the field.

Furthermore, there are several limitations with regards to our experimental design. First, although time pressure is also relevant in outpatient care, we decided for an inpatient care setting in which incoming patients are less manageable and understaffing often present. This scenario might have added some additional complexity to the design. We assume, for instance, that physicians act in alignment with the interests of the hospital. In the real-world, this is certainly not the case for other hospital physicians than chief physicians, whose remuneration often includes performance-based components regarding their department´s budget. However, treatment guidelines at hospitals are mostly determined by chief physicians, and therefore these incentives indirectly exist for other physicians as well. Second, our results may depend on the degree of time pressure participants were faced with and the individual degree of time pressure might have varied across participants. Although we calibrated the latter ex-ante, it might have been rather modest for some participants since our ex-ante calibration did not imply extreme time pressure. Our results regarding the effects of time pressure are therefore rather conservative. Third, we did not control for physician burnout which plays a crucial role in the impact of time pressure and documentation work, as it results from prolonged exposure to such stressors. However, these cumulative effects are hard to replicate in a lab setting with short-term tasks. Our findings therefore only offer a short-term perspective on the consequences of time pressure. Future research could include ex-post experimental measures of chronic stress and burnout to better control for long-term effects.

5. Conclusion

We show that time pressure combined with documentation efforts leads to a decreased treatment quality provided by medical students in the role of hospital physicians. In line with the concept of the speed-accuracy trade-off, we show that quality changes are likely driven by less accuracy. Moreover, we find that while documentation quality is relatively high overall, time pressure significantly lowers the latter leading to a higher hypothetical profit loss for the hospital. In the broader context of economic experiments in healthcare (for a recent overview, see Finocchiaro Castro et al., 2024b[35]), we have thus taken up an important but as yet unexplored topic: the behavior of physicians during peaks in demand or under extreme

conditions such as time pressure. Our results also highlight the need to drive forward the implementation of standardized processes and guidelines as well as innovative healthcare policy measures to facilitate treatment and documentation processes, and thus reduce the time pressure on physicians, e.g. through the use of automation and AI assisted tools.[77] An avenue for future research could be to compare the effectiveness of such measures using our experimental framework.

Online Appendix - https://tinyurl.com/569uaja7

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