

Moderating Role of Cost Accounting Information Quality on the Relationship Between the COVID-19 Pandemic and Budgeting in Public Hospitals

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Based on new public management, information processing theory and contingency theory, this study investigates the impact of the COVID-19 pandemic on budgeting in public hospitals, focusing on budget use. The research hypotheses were tested using a survey of 82 responses from hospital CFOs. The results show that the organisations that were most affected by the pandemic increased their use of budgets for planning, resource allocation and control, compared to those that were less affected. This study also highlights the moderating role of cost accounting information quality in the relationship between crises and budget use. We find that public hospitals that have been most affected by the pandemic and have simultaneously better cost accounting information have increased their use of budgets for planning, resource allocation and cost control more than those whose costing system does not provide superior cost data.

Organisations, including those in the public sector, are trying to respond to an increasingly dynamic and turbulent environment (Hansen and Ferlie 2016). While the importance of management control as a means of monitoring changes in the external environment and their contribution to the adaptation of organisations to changes is widely accepted (e.g., Otley 2008), there is little research on how management control adapts to environmental changes (Hayne 2022). Contingency theory has been used for decades to empirically investigate the relationship between the external environment and management control (Otley 2016).

Responding to invitations from eminent researchers (Hopwood 2009; Van der Stede 2011), several studies have shown that management control changes to respond to uncertainty, environmental turbulence and economic crises (e.g., Janke et al. 2014; Becker et al. 2016). Although the basic principles of the relationship between a crisis and management control practices are known, our knowledge of them remains limited (Rikhardsson et al. 2021). Bedford et al. (2022) report that there is limited quantitative empirical research on the impact of a crisis on budgets. In addition, there are mixed results on this relationship in the literature (e.g., Pavlatos and Kostakis 2015; Becker et al. 2016) and this needs to be explored. According to Jankie et al. (2014), the factors that mediate or moderate the relationship between crisis and management control need to be investigated.

The literature has recorded different types of crises (Pergel and Pshychogios 2013), including crises caused by pandemics (Tse et al. 2006), such as SARS, MERS, Ebola and Zika. SARS-CoV-2 (COVID-19) is a novel virus that was first detected in Wuhan, China in late 2019; it resulted in a global pandemic and a long-lasting crisis with serious consequences (e.g., Abu Bakar and Rosbi 2020). Health-related crises may affect different sectors of society and human productivity, such as tourism, trade and all operations of the public sector (Ruiz Estrada et al. 2020). The COVID-19 pandemic is a new form of external crisis and uncertainty that differs from perceived environmental uncertainty (PEU), which covers areas such as technological change and competition (Sharma et al. 2020). Although it has some features in common with economic crises, it does not identify exclusively with them (Hydman and McKillop (2019). Bedford et al. (2022) argue that investigation of the impact of a crisis in accounting practices has focused on private sector companies and call for research in the new public management (NPM) agenda (Hyndman and Lapsley 2016; Steccolini 2019) to study how a crisis affects the accounting systems of public sector

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organisations and brings about management control changes. The purpose of this study, in response to the above calls, is to investigate the impact of the COVID-19 pandemic, as a new form of crisis and uncertainty, on budgeting practices in public sector organisations, particularly the use of budgets for various purposes. We chose to study public hospitals for two reasons. First, they were more affected by health crises than other public organisations. Second, there is strong research interest in cost and management accounting issues in relation to hospitals (e.g., Pizzini 2006; Chapman et al. 2014).

Although the role of cost accounting information quality in decision making and management control has been studied in the literature (Anderson 2006; Pizzini 2006), there is insufficient evidence on how this relates to the crisis. Cui et al. (2019) argue that the cost information provided by the cost systems of public hospitals plays an important role in managing a crisis, which needs to be studied.

The purpose of this work is two-fold: to examine the effect of the COVID-19 pandemic on budget use in public hospitals and to investigate the moderating role of the quality of cost information in the relationship between the effect of the COVID-19 pandemic and budgeting. We surveyed 82 CFOs of public hospitals during the second wave of the pandemic and found that public hospitals most impacted by the pandemic significantly increased the intensity of budget use for planning, resource allocation and cost control (no change in the intensity of budget use for performance evaluation) when compared to public organisations that were least affected by the pandemic. In addition, we found that public hospitals that have been most affected by the pandemic and have better cost accounting information have increased their use of budgets for planning, resource allocation and cost control more than those whose costing systems provide lower-quality costing information.

This study makes the following contributions. First, it contributes to a better understanding of how budgeting practices are used and influenced by organisational responses to crises. Second, it provides empirical evidence on the moderating role of cost accounting information in the relationship between the effect of a crisis and budget use. We extend the work of Becker et al. (2016) by providing empirical evidence on the moderating role of cost accounting information on the relationship between the effect of a crisis and budgeting. We not only explore actual changes in the intensity of budget use (and not because perceptions of their importance have changed), we also highlight the role of cost system design (an under-researched moderator) in changing the degree of budget use in a crisis environment. We examine how the quality of cost accounting information provided by the cost system interacts with the impact of a crisis on enterprises and brings about changes in the intensity of budget use for management control

purposes. We have developed a more complex model than those found in previous studies by investigating both the direct effects and the moderating impact of the quality of cost information to better understand how crises influence budgeting.

Previous work has dealt mainly with financial crises (e.g., Eendenich 2014; Becker et al. 2016). Becker et al. (2016) state that the relationship between other forms of crises, in addition to financial crises, and management control practices needs to be investigated. Therefore, the third contribution of this study is that it investigates a new form of crisis and uncertainty – the health crisis – and how it affects management control practices. This study contributes to a better understanding of the role and use of management control in an environment of emergency and exogenous shock (i.e., a pandemic crisis), which has not been sufficiently studied in the accounting literature (e.g., Passetti et al. 2021). It also increases our knowledge of how contingency studies that examine the effects of the external environment on management control (e.g., Otley 2016) should distinguish crisis (e.g., economic and pandemic) from PEU, as it constitutes another form of uncertainty (Becker et al. 2016).

Fourth, this study provides new empirical evidence for the drivers that lead to changes in management control and accounting reform in public sector organisations. It also provides new insight into how existing budgeting systems in public organisations change to manage alterations in their external environment. Finally, this study contributes to health management in the context of NPM as it illustrates how hospitals can manage crises using management control practices.

Theory and Hypotheses Development

New public management and management control

NPM, which first appeared in the UK, focuses on reducing the expenses of the public sector and its personnel, privatising the majority of its functions and overseeing change (reform and modernisation) within it (Hood 1991, 1995). Public sector organisations try to adopt management practices applied in the private sector (Hood and Jackson 1991), with the goal of improving their efficiency and effectiveness (Battistelli and Ricotta 2005; Barretta and Busco 2011). To this end, changes were observed in the organisational structure of public enterprises; the degree of decentralisation increased (Dunleavy and Hood 1994), and accounting norms and tools that had been applied for the exercise of administrative control in the private sector were adopted (Hood 1991, 1995). The existence of increased accountability in public sector organisations requires them to plan their activities, quantify their objectives by developing budgets and use them for management

control (i.e., management control tasks), performance and managerial evaluation (Hood and Jackson, 1991). Through the budgetary control system, management control allows measurement of the efficiency and effectiveness of public sector organisations (Battistelli and Ricotta 2005).

The public budgeting literature uses budgets in two ways: to regulate relationships across organisations, which has an inter-organisational focus, or across units within the same organisation, which reflects an intra-organisational focus (Pessina et al. 2016). According to Schick (2009), budgets in public sector organisations have three different functions: allocative, managerial and external accountability. Regarding the allocative function, budgets define the upper limits of expenses and allocate them according to purpose or organisational unit. In the managerial function, managers are assigned tasks and corresponding goals, and then achievement checks are made. Regarding the external accountability function, a government is accountable to the legislature and external stakeholders. Budgeting's managerial function is closely related to NPM (Pessina et al. 2016).

Environmental turbulence, contingency theory and changes in management control

Sudden events that occur in the external environment can affect an organisation and force it to react (Suarez and Oliva 2005). These events increase PEU and change organisations (Bedford and Malmi 2015). According to contingency theory, efficient organisational structures depend on a variety of contextual factors such as the environment (Otley 1980, 2016). These factors may explain why accounting systems differ from one organisation to another (Chenhall 2003, 2006).

Environmental turbulence is considered to be an inherent uncertainty in the development of external forces that affect the organisation, such as political, economic and social forces, natural disasters, and uncertainty from the behaviour of customers, suppliers and employees (Ekholm and Wallin 2011). The nature and extent of an organisation's reactions depend on the type and severity of the change (Hoque 2004). Suarez and Oliva (2005) propose a framework for classifying the severity of environmental turbulence into five categories: regular, hyperturbulence, specific shock, disruptive and avalanche.

In the management control literature, it is argued that, generally, as environmental turbulence increases, controls become more flexible and open, and the organisation becomes less dependent on action controls and more dependent on result controls (e.g., Chenhall and Langfield-Smith 2007; Merchant and Van der Stede 2012). Malmi and Brown (2008) note that it is difficult to generalise the relationship between various elements

of management control and environmental turbulence. They consider that increased environmental turbulence can lead to both increased audits and looser behavioural controls, which needs to be studied.

Crises and management controls

Crises, as a form of environmental turbulence, are significant threats to the viability and goals of an organisation and are characterised by a high degree of uncertainty and ambiguity, lack of control and reduced response time (Bundy et al. 2017). In a crisis environment, organisations are more interested in maintaining efficiency and conserving resources, and try to save time in understanding how they can better manage the threat (Hopwood 2009; Becker et al. 2016). The literature mainly deals with the relationship between financial crises and management controls (Arnold 2009). Staw et al. (1981) and Van der Stede (2011) report that organisations' concerns about their efficiency come with tightening of their budgets, increased cost reduction and increased effort for accountability. Pavlatos and Kostakis (2015) found that the financial crisis directed companies toward the adoption and use of new costing systems, but they did not find significant changes in the use of budgets, compared to Enderich (2014), who found that crises changed budgeting. Jankie et al. (2014) found that a financial crisis led to more interactive use of management controls. In addition, Becker et al. (2016) found that, in a crisis environment, the importance of budgeting for planning use increases, while the importance of budgeting for performance evaluation decreases.

COVID-19, management controls and budgeting

The COVID-19 pandemic has forced governments to increase public spending on health, which has affected government budgets at the national level (Rinaldy 2022). For example, Heald and Hodges (2020) report that the pandemic has had a dramatic impact on UK government finances and its national budget. Leoni et al. (2021) highlight the role of accounting and numbers in supporting governmental responses to COVID-19. The debate on budgeting responses to the COVID-19 pandemic has been linked to the view that budgets should have a strategic focus (Anessi-Pessina et al. 2020). Public budgets need to be more flexible to enable governments to better manage the pandemic (Liao et al. 2021). Rinaldy (2022) states that government budgeting should support policy decision making and public accountability. In addition, Ahrens and Ferry (2021) state that uncertainty makes better planning necessary, and that governments need to pursue accounting reforms to improve future financial resilience.

At the firm and organisational level, Bedford et al. (2022) use survey data from 83 Dutch firms and found that a more negative effect of the COVID-19 pandemic is positively associated with a shrinking in budget controls. This tightening of budget controls is positively related to employees' emotional exhaustion because of their increased perceptions of role ambiguity and conflict. Delfino and van der Kolk (2021) found that the pandemic brought about changes in management control, such as increasing the number of online meetings and the use of technologies to supervise employees remotely. Huber et al. (2021) investigate the impact of the pandemic in five German hospitals and found that accounting information played an important role in managing the uncertainty created by the pandemic.

Hypotheses development

Budgets can be used in a variety of strategies, such as planning, resource allocation, control and performance evaluation (e.g., Hansen and Van der Stede 2004; Henri et al. 2019). In this study, we hypothesise that the health crisis, as a new form of uncertainty and environmental turbulence, increases the use of budgets for planning. The COVID-19 pandemic, as a new form of external crisis that leads to increased uncertainty, also leads to increased pressure on the administration of public hospitals to ensure that the organisation does not deviate from its goals. Khandwalla (1978) argues that organisations increase planning operations to reduce uncertainty. Previous research has shown that in new situations with limited knowledge of their effects, organisations are driven to plan in order to reduce uncertainty (Billings et al. 1980; Palermo and Van der Stede 2011). Therefore, we believe that public hospital administrations will increase the frequency with which they update their plans and will develop different scenarios for the impact of the health crisis on their operations to reduce their response time when those scenarios occur.

Moreover, public hospital administrations most affected by the pandemic are likely to increase the intensity of budget use for planning to investigate and anticipate environmental uncertainties caused by the health crisis, and to investigate the impact of revenue uncertainties in hospitals, their productive operations, stocks, investments in equipment and liquidity. These actions will help them better respond to the COVID-19 pandemic and better coordinate the actions required to achieve their plans. They will also improve communication between departments (directorates and clinics) of hospitals in order to respond to the pandemic more effectively.

We also assume that the pandemic will increase the use of budgets for resource allocation. Previous research has shown that a crisis environment leads to reduced

availability of funds in organisations (Allen and Carletti 2010), resulting in better resource management. We believe that it is possible that the health crisis will result in reduced hospital revenues from other sources (examinations and treatments other than COVID-19), and this will in turn result in fewer opportunities for hospital administrations to purchase necessary supplies and equipment with operating cash flow. Thus, their administrations will either have to turn to state funding (which in some cases may be delayed) or use their savings. Hopwood (2009) states that, in a crisis environment, it is very important for an organisation's management to maintain its liquidity and to properly manage its resources. Zona (2012) states that during a crisis, the distribution of the limited resources of an organisation is usually centralised by top management to ensure a more rational distribution. Therefore, it is likely that public hospital administrations most affected by the health crisis will increase the intensity of budget use for resource allocation so that there is greater financial discipline and better cash flow management.

We also assume that the pandemic leads to increased use of budgets for cost control. The literature has shown that budgets can help managers manage and control an organisation's operations (Hansen and Van der Stede 2004). A budgetary control system using variance analysis can effectively help control costs per department, service, activity, and operation (Kaplan and Cooper 1998). We believe that it is possible for public hospitals most affected by the health crisis to show an increase in operating costs. This increase, combined with a reduction in cash flow, requires better analysis, monitoring and control of their operating costs to better manage or even reduce them without affecting the operation of hospitals and the quality of their services.

Based on the above, we propose the following research hypothesis:

H1: Public hospitals that are most affected by the pandemic increase the use of budgets for planning, resource allocation and control of costs, as compared to public hospitals that are less affected by the pandemic.

In contrast to previous budgets, we assume that a health crisis leads to a reduction in the intensity of budget use for performance evaluation. Goal theory states that for a budget to be used effectively in evaluating the performance of managers in relation to whether objectives are met, it is essential for managers to believe that the objectives can be achieved (Epstein and Manzoni 2002). The COVID-19 pandemic, along with the new crisis environment created by it, may have made budget targets quite ambitious, unachievable and unsuitable for comparison with real amounts to evaluate the performance of managers. The literature argues that any

revision of the objectives to approach these new conditions cannot be used effectively to evaluate managers' performance (e.g., Haka and Krishnan 2005).

Under conditions of increased uncertainty, the evaluation of performance through budgets is considered inappropriate because during these periods, organisations are unable to set goals (Sharma 2002; Becker et al. 2016). The management accounting literature argues that budgets should not be used to evaluate executives under conditions of increased uncertainty, which is particularly intense in the case of the COVID-19 pandemic, because the achievement of goals depends on uncontrolled factors and not on the actions of executives (Otley 2014). We assume that public hospitals most affected by the pandemic may use more management control tools, such as non-financial measures, to evaluate the performance of their executives and to lower budgets (e.g., Chenhall and Chapman 2006; Naranjo-Gil and Frank Hartmann 2007; Abernethy and Mundy 2014), compared to hospitals that are less affected.

Therefore, our second hypothesis is as follows:

H2: Public hospitals most affected by the pandemic decrease the intensity of budget use for performance evaluation compared to hospitals that are less affected.

We hypothesise that the quality of cost accounting information moderates the relationship between the effect of the COVID-19 pandemic and changes in the intensity of budget use. Hopwood (2009) highlights the role of information as an effective response to an economic crisis. He states that information can help reduce the uncertainty caused by the crisis. According to the information-processing theory, the level of uncertainty, which is considered an external factor (Widener 2007), affects the level of information required to perform an activity. Additionally, in an environment of increased uncertainty, more sophisticated information must be collected and processed (Galbraith 1973). By contrast, in an environment of low uncertainty, most of the information required for making management decisions is already available from the organisation's past experience. In conditions of increased uncertainty, it is therefore necessary for organisations to adopt more comprehensive systems that can provide sufficient information in these situations (Birnberg et al. 2007).

The COVID-19 pandemic, as a new form of uncertainty, has led to increased information intensity (Hopwood 2009), and the gap between available and required accounting information for management control is widening (Galbraith 1974; Chapman 1998). Therefore, we believe that better quality information for organisational control is required to manage the pandemic.

Schoute and Budding (2017) found a relationship between external crises and cost system design. The quality of the cost information provided by a cost system improves the financial performance of an organisation and can be used effectively in management control (Pizzini 2006). Anderson (2006) states that superior cost accounting information increases organisational cost transparency and helps to better control and manage costs in relation to the goals of the organisation. Cost information is essential for budgeting (Kaplan and Cooper 1998). If an organisation has a well-developed costing system that provides detailed, updated and comprehensive information, the budgets prepared reflect those characteristics and allow them to be used effectively for various purposes, such as planning, resource allocation, control and performance evaluation (Merchant 1981; Kaplan and Cooper 1998).

High-quality cost information is valuable in public hospitals (Pizzini 2006; Chapman and Kern 2010; Chapman et al. 2014; Chapman et al. 2022), as well as in its contribution to decision making in the context of NPM. In this study, we assume that it is possible that public hospitals that have been most affected by the health crisis and, simultaneously, have a costing system that provides quality information, further increase the use of budgets for planning, resource allocation and control to enable them to manage changes in their external environment promptly and effectively. In contrast, we assume that when the available cost information is insufficient, hospitals that are most affected by the pandemic are likely to reduce the intensity of budget use for performance evaluation more than hospitals that, because of the better cost information available, can maintain the same level of budget usage for performance evaluation, irrespective of the uncertainty caused by COVID-19.

Based on the above, we propose the following hypothesis:

H3: The quality of cost accounting information moderates the relationship between the effect of the COVID-19 pandemic and changes in the intensity of use of existing budget systems for planning, control, resource allocation and performance evaluation.

Figure 1 illustrates the research model used in this study.

Methodology

Data collection

We collected data during the second wave of the pandemic (November–December 2020) through a web-based survey, following Dillman's (2000) research

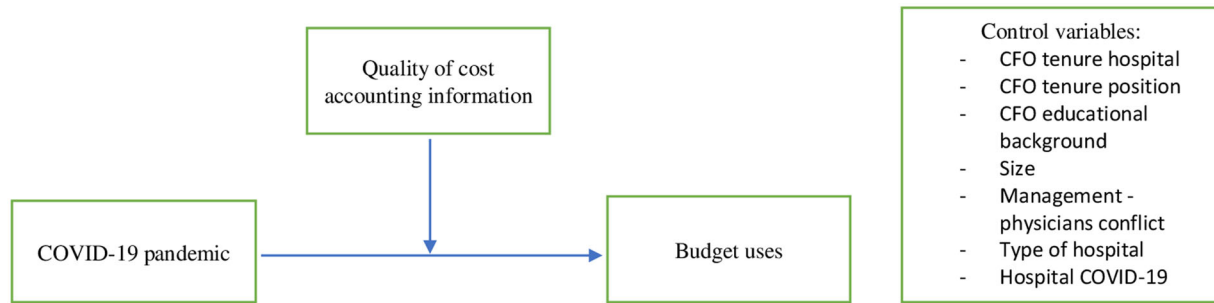


Figure 1 Research model [Colour figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com/doi/10.1111/jaur.12933)]

design guidelines. Prior to distribution, the questionnaire was piloted for face validity by four hospital CFOs and two academics. The sampling frame was obtained from the Greek Ministry of Health, and 112 non-connected public hospitals were identified. A letter summarising the aims of the investigation and asking them to complete the questionnaire electronically was emailed to the hospital CFOs. Fifteen days after the initial dispatch, a reminder email was sent asking participants to complete the questionnaire if they wished to participate in the research. All questionnaires were completed by the CFOs. All research ethical standards, as defined by the General Data Protection Regulation, were observed during data collection.

We received 82 fully completed questionnaires from public hospital CFOs (response rate: 73%). Table 1 presents the characteristics of the sampled hospitals. As the sample size was greater than the number of correlations, PLS analysis was appropriate for our study (Hair et al. 2017). To control for potential non-response bias, we first compared the values of the variables between the early and late respondents and found no statistically significant differences ($p > 0.10$). In addition, chi-square tests indicated no significant differences in hospital characteristics (number of beds, geographical area and type of hospital). Next, we applied Harman's single factor test, that is, we performed an unrotated factor analysis on the 26 variables (items) (budget use, COVID-19 pandemic, quality of cost accounting information). Six factors were formed based on eigenvalues > 1 , with the one-factor solution explaining 22.8% of the total variance. Therefore, non-response bias did not seem to be a problem in our sample.

Measurements, reliability and validity

Budget use was measured using 10 items according to the Chenhall and Langfield-Smith (1998) scale. Respondents were asked to indicate, using a seven-point scale ranging from 1 (strongly decreased) to 7 (strongly increased), the extent to which the use of budgets for various purposes changed during the pandemic com-

pared to the period before its onset. The quality of cost accounting information was based on measurements by Chenhall and Morris (1986) and Pizzini (2006). The construct includes eight items: (1) the cost accounting system provides data that allow me to analyse costs at different levels (e.g., per payer, contract, physician, diem, procedure and activity); (2) the cost accounting system can easily customise reports to the specification of a user (e.g., senior managers, middle managers, clinical managers, medical staff); (3) the cost information arrives immediately upon request; (4) cost reports are provided frequently on a systematic basis; (5) there is no delay between an event occurring and the relevant cost information being reported to you; (6) the cost system has a formalised method of distinguishing between fixed and variable costs; (7) the cost system has a formalised method of distinguishing control/non-controllable costs; and (8) the cost system has a formalised method of distinguishing direct and indirect costs.

Respondents were asked to indicate their degree of agreement or disagreement with the previously mentioned statements on the information provided by their costing system on a scale ranging from 1 (strongly disagree) to 7 (strongly agree). Larger mean scores indicate that the hospital's costing system provides better (higher-quality) cost information.

The effect of the COVID-19 pandemic measurement in hospitals was determined using a scale that we developed based on the pilot study, which was conducted with financial managers of the public hospitals and academics. Respondents were asked to indicate the extent to which their hospital faced certain types of impact as a result of the COVID-19 pandemic. We used eight items that took values from 1 (no extent) to 7 (great extent). We assessed the convergent validity of the construct in two ways. First, we correlated our measure to a proxy single-item measure that captures the perceived overall impact of the COVID-19 pandemic on the financial and operating indices of hospitals. A positive and significant correlation ($r = 0.68$; $p = 0.000$) between the two measures supported the validity of our construct. Second, building on research by Huber et al. (2021), who used the number of COVID patients to measure the im-

Table 1 Descriptive statistics and measurements ($n = 82$)

Items	Mean	S.D.	Min.	Max.
Budget use	4.40	1.17	1	7
For each of the following purposes regarding the use of budgets within your hospital, please indicate to what extent they have changed during COVID-19 pandemic, as compared to the period before the pandemic (1 = Strongly decreased, 7 = Strongly increased)				
bud_1: Budgeting for planning financial position	4.62	1.18	1	7
bud_2: Budgeting for planning day-to-day operations	4.78	1.02	2	7
bud_3: Budgeting for planning cash flows	4.89	0.94	2	7
bud_4: Budgeting for forecasting near-future developments based on plans and evaluating their impact on hospital performance	4.58	1.27	1	7
bud_5: Budgeting for controlling costs	4.48	1.17	2	7
bud_6: Budgeting for comparing planned to actual costs and analysis of variances	4.39	1.24	2	7
bud_7: Budgeting for allocating resources	4.28	1.26	1	7
bud_8: Budgeting for allocating decision making and spending authority	4.23	1.16	1	7
bud_9: Budgeting for evaluating managers' performance	3.91	1.26	1	7
bud_10: Budgeting for compensating managers	3.85	1.17	1	7
COVID-19 pandemic	4.56	1.26	1	7
Please indicate to what extent your hospital faces the following types of impact of the COVID-19 pandemic (1 = No extent, 7 = Great extent)				
Pdm_1: Increase in number of COVID-19 patients	4.72	1.33	1	7
Pdm_2: Increase in need for intensive care units (ICUs)	4.68	1.27	1	7
Pdm_3: Reduction in revenue from tests and hospitalisation days other than COVID-19	4.60	1.16	2	7
Pdm_4: Increase in need for medical and nursing personnel	4.68	1.38	1	7
Pdm_5: Increase in need for medicines/drugs	4.48	1.17	2	7
Pdm_6: Increase in need for consumables (i.e., masks, special uniforms, oxygen)	4.41	1.29	2	7
Pdm_7: Increase in need for medical/non-medical equipment (i.e., ventilators)	4.38	1.21	1	7
Pdm_8: Increase in operating cost of hospital	4.55	1.25	1	7
Quality of cost accounting information	4.32	1.24	1	7
Please indicate the degree to which you agree with the following statements as they apply to your hospital (1 = Strongly disagree, 7 = Strongly agree) regarding the cost accounting system				
func_1: The cost accounting system provides data that allow me to analyse costs at different levels (e.g., per payer, contract, physician, diem, procedure, activity)	4.41	1.18	1	7
func_2: The cost accounting system can easily customise reports to the specification of a user (e.g., senior managers, middle managers, clinical managers, medical staff)	4.21	1.27	1	7
func_3: The cost information arrives immediately upon request	4.31	1.18	2	7
func_4: Cost reports are provided frequently on a systematic basis	4.39	1.24	2	7
func_5: There is no delay between an event occurring and the relevant cost information being reported to you	4.25	1.29	1	6
func_6: The cost system has a formalised method of distinguishing fixed and variable costs	4.62	1.15	2	7
func_7: The cost system has a formalised method of distinguishing control/non-controllable costs	4.17	1.32	1	7
func_8: The cost system has a formalised method of distinguishing direct and indirect costs	4.19	1.28	1	7
CFO tenure in hospital	9.4	3.82	3	17
Please indicate tenure at hospital				
CFO tenure as CFO Please indicate your total number of years' experience as CFO	8.2	2.86	3	19
CFO educational background	1.64	1.02	1	3
Please indicate your educational background (1: BSc, 2: MSc/MBA, 3: PhD)				

(Continued)

Table 1 (Continued)

Items	Mean	S.D.	Min.	Max.
Size of hospital	402	299	80	1740
Please provide the current number of beds in your hospital				
Management–physician conflict	5.62	1.38	3	7
Please indicate the degree to which you agree with the following statement as it applies to your hospital (1: Strongly disagree, 7: Strongly agree)				
Conf_1: The relationship between the management team and our physicians can be described as optimal				
Location	N	%		
Please indicate the location of your hospital				
Attica and Aegean Islands	28	34		
Macedonia/Thrace region	24	29		
Thessaly and Central Greece region	14	17		
Peloponnese, Ionian Islands and Western Greece	14	17		
Crete	2	2		
Type of hospital				
Please indicate type of hospital				
General hospital	72	88		
Specialised hospital	10	12		
COVID-19 hospital				
Please indicate whether your hospital has been designated as a reference hospital for COVID-19 patients				
Yes	11	13		
No	71	87		

pact of the COVID-19 pandemic on hospitals, we collected actual data on the number of inpatient hospitals with COVID-19 from the National Public Health Organization. Thus, we calculated the average number of hospitalised patients with COVID-19 for each hospital in the sample during the survey period. We then correlated this measure (natural logarithm of the mean number of hospitalised patients) with the construct ‘effect of COVID-19 pandemic’ and found a positive and statistically significant correlation ($r = 0.36$; $p = 0.008$), leading us to conclude that our measure has satisfactory convergent validity. We measured the variables ‘budget use’, ‘effect of the COVID-19 pandemic’ and ‘quality of cost accounting information’ as reflective constructs.

In this study, we used several control variables. Initially, we used the characteristics of CFOs because, according to the upper echelons theory (Hambrick 2007), the characteristics of CFOs, such as tenure and educational background, influence accounting choices, such as the use of budgets. Several empirical studies found that CFOs’ tenure is negatively associated with budget use, while CFOs’ educational background is positively associated with budget use (e.g., Pavlatos and Kostakis 2021). The variables ‘CFO tenure in hospital’ and ‘CFO tenure as CFO’ were measured with the natural logarithm of the years of work in the hospital and the natural logarithm of the years the CFO has worked in the position, respectively. The variable ‘CFO educational background’ was initially measured as categorical with three values, depending on the educational back-

ground (1 = BSc, 2 = MSc or MBA, 3 = PhD), while in statistical analyses it was transformed into a dummy that received the value one if the CFO holds a master’s or doctoral degree.

We also used the management team–physician conflict as a control variable. Burns and Scapens (2000) suggest that the successful implementation of change in an organisation requires thorough consideration of potential organisational conflicts. This is the case in hospitals, where management activities (including accounting practices) are loosely linked to clinical (core) activities (i.e., treating patients) (Ballas and Tsoukas 2004; Carr and Beck 2022). Consequently, changes in the intensity of budget use may be achieved more easily in hospitals, where the relationship between management and physicians is portrayed as one of minimal conflict. The variable ‘Management–physician conflict’ was measured with an item that takes values from 1 (strongly disagree) to 7 (strongly agree), in which the respondents were asked to express the degree of their agreement or disagreement regarding the relationship between the management team and the physicians, with value 7 considered optimal.

Hospital size was also used as a control variable, which was measured using the natural logarithm of the number of beds. Previous studies have shown that larger organisations have more resources than they can allocate for implementing formal control systems, such as budget systems (e.g., Pizzini 2006; Naranjo-Gil and Hartmann 2007). We also used some characteristics

of hospitals (general or special care hospital, hospital of reference by the Greek government for COVID-19 patients) as control variables because they are likely to be associated with changes in the use of budgets. We consider that general and reference hospitals for COVID-19 patients may show larger changes in the degree of budget utilisation. The variable 'type' of hospital was measured as a dummy variable that takes a value of one if it is a general hospital. The variable 'COVID-19 hospital' also takes a value of one if the hospital has been designated by the government as a COVID-19 patient reference hospital.

Table 1 shows the descriptive statistics of all survey variables. Separate factor analyses were conducted, one for each construct (budget use, COVID-19 pandemic, quality of cost accounting information) (Table 2). From the factor analysis of budget use, four factors – 'Budget – Planning', 'Budget – Resource allocation', 'Budget – Controlling' and 'Budget – Performance evaluation' – emerged, explaining 77.3% of the total variance (Table 2). Table 2 shows that item loadings in six constructs take values greater than 0.77, implying that there is satisfactory individual item reliability (Hair et al. 2017). Moreover, AVE values are greater than 0.50 and Cronbach's alpha is greater than 0.70, which leads us to conclude that there is satisfactory reliability (Table 2). Moreover, for every construct, the AVE values (Table 2) are greater than the squared correlations between the variables (Table 3), which leads us to conclude that there is satisfactory discriminant validity (Hulland 1999). As shown in Table 3, the correlations between the variables are small, indicating that multicollinearity did not influence our results (Hair et al. 2017). VIF values lead us to the same conclusions, where all constructs vary between 1.048 and 1.132, well below the value of five (Hair et al. 2017).

Results

The research hypotheses were tested using Smart PLS 3.0, a bootstrapping procedure that uses 500 samples with replacement, which is suitable for small samples (Ringle et al. 2014). Table 4 presents the direct effects (main effects), and Table 5 shows the full model, which also contains the interaction effects. To calculate the interaction terms, we first standardised the item scores and then calculated the interaction terms based on the standardised item scores (Chin 1998). Table 4 shows that Hypothesis 1 is supported, as the path coefficient from 'COVID-19 pandemic' is positive and statistically significant for budget use for planning (0.294; p -value = 0.001), controlling (0.288; p -value = 0.002) and resource allocation (0.274; p -value = 0.006). In contrast, Hypothesis 2 is not supported, as the path coefficient from 'COVID-19 pandemic' to 'Budget use

for performance evaluation' is not statistically significant (-0.240 ; p -value = 0.132). Table 5 shows that Hypothesis 3 is partially supported, as 'COVID-19 pandemic' interacts with quality of cost accounting information to provide a positive significant effect on budget use for planning (0.294; p -value = 0.001), controlling (0.289; p -value = 0.004) and resource allocation (0.269; p -value = 0.018). In this model, the 'COVID-19 pandemic' still had a positive and statistically significant effect on budget use for planning (0.290; p -value = 0.002), controlling (0.284; p -value = 0.006) and resource allocation (0.271; p -value = 0.012). In contrast, we observed that 'COVID-19 pandemic' did not interact with the quality of cost information on budget use for performance evaluation (-0.154 ; p -value = 0.121).

Regarding the control variables that were included in both models (main effects, full model), we found a positive and statistically significant relationship between the hospitals designated by the government as COVID-19 reference hospitals and budget use for planning, control and resource allocation. Statistical analysis showed that, in both models, size had a positive and statistically significant relationship with budget use for performance evaluation. In both models, we found a positive and statistically significant effect of management–physician conflict on budget use for performance evaluation. To evaluate the structural models, we calculated the R^2 values for each endogenous construct (Tables 4 and 5). In all cases, the values are above the limit of 10% (Hair et al. 2017). In addition, the values of Stone–Geisser Q^2 in both models for all endogenous variables are above zero (Tables 4 and 5), indicating that our models have good predictability (Hair et al. 2017). To determine the predictive value added by the interaction term (quality of cost information), we compared R^2 and the Stone–Geisser Q^2 of the model (Table 5) with the corresponding values of the model with only the main effects (Table 4). The values of R^2 and Q^2 increased for the dependent variables of the full model, leading us to conclude that the interaction term increased the exploratory power of the model.

Discussion and Conclusions

Based on NPM, information-processing theory and contingency theory, we have investigated the effect of the COVID-19 pandemic on budget use in public hospitals, as well as the moderating role of the quality of cost accounting information in this relationship. Therefore, an empirical study was conducted with a sample of 82 hospitals during the pandemic.

We provide empirical evidence that hospitals that were most affected by the COVID-19 pandemic increased the intensity of their budget use for planning, resource allocation and cost control compared to those that were

Table 2 Exploratory factor analysis, reliability and validity analysis ($n = 82$)

Items	Budget-Planning	Budget-Controlling	Budget – Resource allocation	Budget – Performance evaluation	COVID-19 pandemic	Quality of cost accounting information
bud_1	0.776					
bud_2	0.798					
bud_3	0.821					
bud_4	0.817					
bud_5		0.828				
bud_6		0.792				
bud_7			0.833			
bud_8			0.789			
bud_9				0.894		
bud_10				0.832		
Pdm_1					0.878	
Pdm_2					0.812	
Pdm_3					0.826	
Pdm_4					0.821	
Pdm_5					0.786	
Pdm_6					0.783	
Pdm_7					0.821	
Pdm_8					0.814	
func_1						0.791
func_2						0.824
func_3						0.834
func_4						0.799
func_5						0.772
func_6						0.789
func_7						0.816
func_8						0.848
Cronbach's alpha	0.83	0.82	0.81	0.84	0.85	0.82
Variance extracted	25.7%	18.4%	16.8%	16.4%	74.1%	62.8%
Average variance extracted (AVE)	0.675	0.683	0.621	0.624	0.691	0.707
Internal composite reliability (ICR)	0.825	0.834	0.812	0.818	0.814	0.815

Note: We used maximum likelihood with ProMax rotation to calculate the factor analyses and to extract all factors with eigenvalues > 1. Rotation method: ProMax with Kaiser normalisation.

Table 3 Correlations from PLS model (n = 82)

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Budget –Planning	1												
2. Budget –Controlling	0.19	1											
3. Budget –Resource allocation	0.23	0.18*	1										
4. Budget –Performance evaluation	0.21	0.24	0.19	1									
5. COVID-19 pandemic	0.24*	0.27*	0.23*	-0.14	1								
6. Quality of cost accounting information	0.25*	0.24*	0.27*	0.22*	0.25*	1							
7. CFO tenure hospital	0.18*	0.21	0.25	0.12	0.14	0.18*	1						
8. CFO tenure position	0.16	0.24	0.18	0.18	0.19	0.20*	0.17	1					
9. CFO educational background	0.18	0.22	0.19	0.24	0.07	0.23*	0.22	0.30	1				
10. Size	0.20	0.25	0.17	0.19**	0.23	0.18	0.12	0.26	0.14	1			
11. Management – Physician's conflict	0.21	0.18	0.24	0.20**	0.20	0.18	0.24	0.29	0.22	0.21	1		
12. Type of hospital	0.18	0.14	0.17	0.16	0.19	0.21	0.26	0.12	0.18	0.14*	0.18	1	
13. Hospital COVID-19	0.17*	0.19*	0.21*	0.20	0.24*	0.15*	0.27	-0.14	0.26	0.21	0.24	0.20*	1

NOTE: *Indicates correlations are significant at the .05 level (two-tailed)
 **Indicates correlations are significant at the .01 level (two-tailed)

least affected. To reduce the uncertainty caused by the health crisis, as well as to apply better crisis management and respond to the pandemic more effectively, public hospital administrations increasingly use budgets for planning, resource allocation and control. Through budgets, they develop scenarios to observe the effects of the pandemic in achieving their goals, allocating their limited resources and controlling their operating costs.

Thus, we found that the health crisis is a driver of changes in the intensity of use of the existing budget system in public hospitals, confirming the contingency theory (Otley 2014). The pandemic, as a new form of uncertainty and crisis, can exert pressure on the management and control of public organisations. If it were not for the sudden shock caused by the pandemic, this increase in the use of budgets for planning, control and resource allocation would not yet have taken place. Contrary to expectations, the COVID-19 pandemic did not affect the use of budgets for performance evaluations. This may be attributed to the fact that the use of budgets for planning and performance evaluation is separated in time (Barrett and Fraser 1977; Østergren and Stensaker 2011). It is possible that hospitals immediately changed the intensity of their budget use for planning, resource allocation and control, believing that these budget functions were more useful in managing the pandemic. The reduction in the intensity of budget use for performance evaluation may not have taken place when the survey was conducted and may have occurred at a later time.

In addition, this study highlights the moderating role of cost accounting information quality in the relationship between the impact of a crisis and budget use. We found that public hospitals that have a costing system that provides better cost data and increases the use of budgets for planning, resource allocation and cost control are more affected by the pandemic than those that do not. The positive relationship between the pandemic and budget use for planning, control and resource allocation was stronger for hospitals whose costing systems provided better costing information. Superior cost accounting information enables hospitals to change the use of budgets more intensively and respond more quickly to changes in the external environment. When better cost information is available, it is easier to make changes in the decision-making process in planning, resource allocation and cost control through budgets so that hospitals can better manage the pandemic.

This study makes several contributions to the literature. First, we enrich our knowledge of organisational changes in budgeting practices in response to crises. We found that the health crisis, compared to the financial crisis, brought about a different pattern of behaviour in the use of budgets. Pavlatos and Kostakis (2015), who

Table 4 Results from PLS analysis – Main effects only ($n = 82$)

Path	Path coefficient	p-value	Cohen's f^2
COVID-19 pandemic → Budget – Planning	0.294*	0.001	0.27
COVID-19 pandemic → Budget – Controlling	0.288*	0.002	0.25
COVID-19 pandemic → Budget – Resource allocation	0.274*	0.006	0.23
COVID-19 Pandemic → Budget – Performance evaluation	-0.140	0.132	
<i>Control variables</i>			
CFO tenure hospital → Budget – Planning	0.144	0.127	
CFO tenure position → Budget – Planning	0.114	0.171	
CFO educational background → Budget – Planning	0.134	0.138	
Size → Budget – Planning	0.118	0.133	
Management – Physician's conflict → Budget – Planning	0.134	0.089	
Type of hospital → Budget – Planning	0.117	0.133	
Hospital COVID-19 → Budget – Planning	0.222*	0.025	0.18
CFO tenure hospital → Budget – Controlling	0.091	0.204	
CFO tenure position → Budget – Controlling	0.117	0.166	
CFO educational background → Budget – Controlling	0.129	0.142	
Size → Budget – Controlling	0.078	0.223	
Management – Physicians conflict → Budget – Controlling	0.015	0.261	
Type of hospital → Budget – Controlling	0.034	0.231	
Hospital COVID-19 → Budget – Controlling	0.218*	0.029	0.16
CFO tenure hospital → Budget – Resource allocation	0.118	0.162	
CFO tenure position → Budget – Resource allocation	0.023	0.258	
CFO educational background → Budget – Resource allocation	0.121	0.155	
Size → Budget – Resource allocation	0.142	0.129	
Management – Physicians conflict → Budget – Resource allocation	0.088	0.219	
Type of hospital → Budget – Resource allocation	0.201*	0.035	0.11
Hospital COVID-19 → Budget – Resource allocation	0.088	0.219	
CFO tenure hospital → Budget – Performance evaluation	0.091	0.217	
CFO tenure position → Budget – Performance evaluation	0.104	0.186	
CFO educational background → Budget – Performance evaluation	0.136	0.136	
Size → Budget – Performance evaluation	0.205*	0.034	0.14
Management – Physicians conflict → Budget – Performance evaluation	0.230*	0.019	0.20
Type of hospital → Budget – Performance evaluation	0.015	0.261	
Hospital COVID-19 → Budget – Performance evaluation	0.113	0.175	
R^2 (Budgets – Planning) = 0.236			
R^2 (Budgets – Controlling) = 0.220			
R^2 (Budgets – Resource allocation) = 0.217			
Q^2 (Budgets – Planning) = 0.132			
Q^2 (Budgets – Controlling) = 0.113			
Q^2 (Budgets – Resource allocation) = 0.124			

NOTE: *Indicates correlations are significant at the .05 level (two-tailed); Cohen's f^2 indicates effect sizes that are small (0.02), medium (0.15) or large (0.35); Size: natural logarithm of number of beds; CFO tenure hospital: natural logarithm of years worked in hospital; CFO tenure position: natural logarithm of years worked as CFO; Type of hospital: dummy variable takes the value one if the hospital is a general hospital; Hospital COVID-19: Type of hospital: dummy variable takes the value one if the hospital has been designated as a reference hospital for COVID-19 patients.

also document changes in the degree of budget use for different purposes (rather than changes in perceptions of their importance), found that organisations did not change the intensity of their budget use for different purposes (roles) within the financial crisis period compared to the period before it. Therefore, based on the findings of our study, we conclude that the COVID-19 pandemic has a different impact on the degree of budget use compared to the financial crisis that occurred approximately 20 years ago. Organisations used budgets for planning, resource allocation and control to manage

the pandemic; however, they did not make such changes to manage the financial crisis.

Second, the study highlights the role of costing information provided by organisations' costing systems in changes to the degree of budget use. We highlight the supportive role of cost system design in changes in the degree of budget utilisation. The quality of cost accounting information works in a complementary way to the crisis and brings about changes in existing budgeting systems. We attempt to answer Jankie et al.'s (2014) call to investigate whether certain factors moderate or mediate the relationship between crises and management

Table 5 Results from PLS analysis– Full model ($n = 82$)

Path	Path coefficient	p -value	Cohen's f^2
COVID-19 pandemic → Budget – Planning	0.290*	0.002	0.26
COVID-19 pandemic → Budget – Controlling	0.284*	0.006	0.22
COVID-19 pandemic → Budget – Resource allocation	0.271*	0.012	0.21
COVID-19 pandemic → Budget – Performance evaluation	–0.149	0.130	
COVID-19 pandemic * Quality of cost accounting information → Budget – Planning	0.294*	0.001	0.27
COVID-19 pandemic * Quality of cost accounting information → Budget – Controlling	0.289*	0.004	0.23
COVID-19 pandemic * Quality of cost accounting information → Budget – Resource allocation	0.269*	0.018	0.20
COVID-19 pandemic * Quality of cost accounting information → Budget – Performance evaluation	–0.154	0.121	
<i>Control variables</i>			
CFO tenure hospital → Budget – Planning	0.142	0.128	
CFO tenure position → Budget – Planning	0.118	0.167	
CFO educational background → Budget – Planning	0.139	0.135	
Size → Budget – Planning	0.116	0.130	
Management – Physician's conflict → Budget – Planning	0.137	0.085	
Type of hospital → Budget – Planning	0.110	0.139	
Hospital COVID-19 → Budget – Planning	0.212*	0.032	0.11
CFO tenure hospital → Budget – Controlling	0.101	0.201	
CFO tenure position → Budget – Controlling	0.115	0.256	
CFO educational background → Budget – Controlling	0.132	0.158	
Size → Budget – Controlling	0.082	0.127	
Management – Physicians conflict → Budget – Controlling	0.019	0.216	
Type of hospital → Budget – Controlling	0.037	0.228	
Hospital COVID-19 → Budget – Controlling	0.214*	0.029	0.15
CFO tenure hospital → Budget – Resource allocation	0.116	0.164	
CFO tenure position → Budget – Resource allocation	0.025	0.254	
CFO educational background → Budget – Resource allocation	0.121	0.155	
Size → Budget – Resource allocation	0.140	0.131	
Management – Physician's conflict → Budget –Resource allocation	0.094	0.216	
Type of hospital → Budget – Resource allocation	0.120	0.158	
Hospital COVID-19 → Budget – Resource allocation	0.209*	0.036	0.10
CFO tenure hospital → Budget – Performance evaluation	0.090	0.217	
CFO tenure position → Budget – Performance evaluation	0.114	0.183	
CFO educational background → Budget – Performance evaluation	0.138	0.135	
Size → Budget – Performance evaluation	0.199*	0.042	0.08
Management – Physician's conflict → Budget – Performance evaluation	0.248*	0.025	0.18
Type of hospital → Budget – Performance evaluation	0.012	0.260	
Hospital COVID-19 → Budget – Performance evaluation	0.116	0.172	
R^2 (Budgets – Planning) = 0.289			
R^2 (Budgets – Controlling) = 0.272			
R^2 (Budgets – Resource allocation) = 0.261			
Q^2 (Budgets – Planning) = 0.188			
Q^2 (Budgets – Controlling) = 0.176			
Q^2 (Budgets – Resource allocation) = 0.171			

NOTE: *Indicates correlations are significant at the .05 level (two-tailed); Cohen's f^2 indicates effect sizes that are small (0.02), medium (0.15) or large (0.35); Size: natural logarithm of number of beds; CFO tenure position: natural logarithm of years worked in hospital; CFO tenure position: natural logarithm of years worked as CFO. Type of hospital: dummy variable takes the value one if the hospital is a general hospital; Hospital COVID-19: Type of hospital: dummy variable takes the value one if the hospital has been designated as a reference hospital for COVID-19 patients.

control. This study helps improve our understanding of how an organisation's budgeting system changes in a crisis environment and explains the role of the costing systems in this change. We explore the role of cost accounting information quality, which has received little atten-

tion in the budgeting literature to date. To the best of our knowledge, it has not been investigated in any model in the relevant literature.

Third, it provides insights into how the crisis leads to a change in management control through budgeting in

public organisations and contributes to their accounting reform. This study provides empirical evidence on how a crisis leads to changes in the use of management accounting tools by public hospitals in response to changes in the external environment. Therefore, this study differs from similar studies conducted in public sector organisations in that it does not examine the relationship between the intensity of budget use and the level of impact of a crisis, but rather how changes in the intensity of budget use are related to changes in the impact of a crisis.

This study has managerial implications for public policymakers, regulators and senior executives of public organisations. The findings highlight the role of budgeting in managing uncertainty brought about by the pandemic. Through budgets, hospital managers and public organisations can improve management control and effectively manage changes in their external environment. In addition, they highlight the importance of cost information in managing uncertainty. When cost accounting systems provide superior information, they can improve the decision-making process and reduce uncertainty. Hence, it is necessary to redesign the costing systems of hospitals within NPM to provide timely, analytical and relevant information to increase management control effectiveness. In addition, public policymakers and regulators may find it useful to demand greater accountability from public organisations regarding their costing data, recognising that this information is useful for all stakeholders.

This study has some limitations. First, the findings can only be generalised to public hospitals. The impact of the pandemic on other public organisations should be investigated in the future. Second, the research was conducted in the Greek environment; therefore, the results are valid only for this population. In addition, although it was representative of the Greek population, the sample size is small. Third, this study considers budgeting as a tool for strategy implementation rather than strategy formulation (Simons 1995). Fourth, we did not explore the external accountability function of budgeting and focused mainly on the managerial functions of budgets because these are more in line with the NPM agenda (Pessina et al. 2016).

Future research can investigate other management control techniques, such as non-financial performance measures, or how the personality traits of top management executives, such as growth mindset, affect management control change (Abernethy et al. 2021). In addition, a qualitative survey can be conducted through interviews with executives of public organisations to examine how and why public hospitals change the intensity of their budget use for management control purposes.

Conflict of Interest

No potential competing interest was reported by the authors.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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