

Hardiness vs Alienation Personality Construct Essentially Explains Burnout Proclivity and Erroneous Computer Entry Problems in Rural Hellenic Hospital Labs

Angela-M. Paleologou, Aphrodite Dellaporta

Abstract—Erroneous computer entry problems [here: ‘e-errors’] in hospital labs threaten the patients’–health carers’ relationship, undermining the health system credibility. Are e-errors random, and do lab professionals make them accidentally, or may they be traced through meaningful determinants? Theories on internal causality of mistakes compel to seek specific causal ascriptions of hospital lab e-errors instead of accepting some inescapability. Undeniably, ‘*To Err is Human*’. But in view of rapid global health organizational changes, e-errors are too expensive to lack in-depth considerations. Yet, that e-function might supposedly be entrenched in the health carers’ job description remains under dispute – at least for Hellenic labs, where e-use falls behind generalized(able) appreciation and application. In this study: i) an empirical basis of a truly high annual cost of e-errors at about €498,000.00 per rural Hellenic hospital was established, hence interest in exploring the issue was sufficiently substantiated; ii) a sample of 270 lab-expert nurses, technicians and doctors were assessed on several personality, burnout and e-error measures, and iii) the hypothesis that the Hardiness vs Alienation personality construct disposition explains resistance vs proclivity to e-errors was tested and verified: Hardiness operates as a resilience source in the encounter of high pressures experienced in the hospital lab, whereas its ‘opposite’, i.e., Alienation, functions as a predictor, not only of making e-errors, but also of leading to burn-out. Implications for apt interventions are discussed.

Keywords—Hospital lab, personality hardiness/alienation, e-errors’ cost, burnout.

I. INTRODUCTION

ERRONEOUS computer entry problems (hereafter: e-errors¹) in laboratory information systems may well

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¹ ‘e-errors’, ‘e-use’, and their pertinent connotations with the ‘e-’ prefix is an arbitrary selection of words chosen here to briefly and concisely refer to asynchronous use of electronic laboratory information systems for hospital functions and to describe the mistakes (if any) made by the lab staff while recording patient cases in lab computers. For this article the choice seeks its origin from more popular uses of the same ‘e’ prefix as, for example, in the meaning of ‘e-health’ or ‘ehealth’, and draws its meaningfulness especially from accredited Journals as: *Topics in Health Information Management, International Journal of Medical Informatics, Artificial Intelligence in*

undermine the relationship between patients and their doctors, as well as the medical staff in general, while undervaluing the very credibility of the entire health system. Are such e-errors random, and do lab professionals make them quite accidentally and indiscriminately, or can these e-errors be traced on the basis of some meaningful determinants? Drawing from distant theories in the realm of psychology bordering philosophy [1] on the internal causality of mistakes, it may be suspected that monitoring hospital lab e-errors might need specific causal ascriptions instead of just accepting them as some inescapable occurrences. That ‘*To Err is Human*’ as the US Institute of Medicine report has remarked since 1999 while joylessly ascertaining e-errors’ occurrences [2] is surely indisputable. However, concurrent critical global organizational changes that occur in bewildering rapidity within the health system, e-errors appear too prohibitively expensive to confute thorough and, indeed, multidimensional contemplation [3]. That is, it gradually appears even simplistic to look just for the cost of isolated consequences of e-errors, such as timing and transportation issues for the hospital staff or the patients; or just for partial accumulating costs of e.g., reactors; or even look just for aspects of (any lack of) technical equipment for effective e-recordings; or, still, look just for facets involving the mere screening for everyday occupational stressors and hazards. Despite the usefulness of such aspects, confinement to investigating them does not appear to suffice. Although previous studies [5],[18] and [19], exploring such issues are instructive for mapping the area, however, they still seem to leave out possible deeper causes of erroneous e-use performances. Personality determinants, and, in particular, the Hardiness-vs-Alienation compound may be thought of as such deeper causality factors potentially able to explain both, e-use performance and proclivity to burnout of sensitive laboratory professionals.

A. Costly Facts

The MEDMARX [3] report, analyzing US medical errors from 174,109 cases in 2002 determined an 11% for 2001 and a 10.3% for the next year attributable to e-errors only. Computer entry errors were slightly less likely to be cited in adverse

Medicine, and JAMIA (Journal of the American Medical Informatics Association).

incidents which resulted in harm to a patient (in 2002, 8.2% of reports), yet the medical care costs entailed were very real, although not directly computed to this end. Similarly, for the same periods, only the 'PESYP' of the Hellenic Ionian Islands rural hospital report – to evoke just one of the 17 representative organizations controlling for the hospitals of Hellas – recognized distinctive failure in accurately identifying the range and proportions of medical errors per category, due to dearth of consistent computer entries for the district it controls, thus concluding just by rough inferences in that e-errors might hold the fourth position of medical mishaps [4] – an estimate, that was again not directly linked to its monetary effects. In fact, remarks of this kind are not entirely surprising. As recently as in 2005, Urquhart and Currel pinpointed such discrepancies between hospital lab paper- and e-records that led them to refrain from suggesting anything [5] but further research before reaching beneficial accounts on behalf of the patients concerned. To look at the greater picture, since reports of 2002 to date, communication issues combined are found to be the third leading cause of medical errors in the US [6] – a finding that could not be easily perceived as limited beyond European boundaries.

Due to the lack of transnational and, indeed, intercultural comparative data, the issue of e-error costs may quite suitably be approached by inference, while studying, for instance, selective estimates from the point of view of savings – again, only in certain indicative specialty reports, or in certain observations about particular cost-categories. For example, already since 2000, Ellis and Dushman-Ellis calculated the financial savings when using information technologies to facilitate regionalization of treatment for patients with cardiac problems [7]. Additionally, some researchers [8], [9] have presented persuasive arguments on the cost-saving value of computerized, (non-)corollary medication orders to deal with errors of omission in the physician-pharmacist communication channel on drug prescriptions.

B. Ideological Issues

Still, the underlying assumption that e-functions should be perceived as supposedly entrenched in the job description of health carers remains an issue largely unaccounted for [10] – at least for some countries, as Hellas, where information technologies appear [4] to fall behind generalized(able) acknowledgement and use. It may be postulated that e-use, despite its advantages for freeing, if anything, from handwriting obligations, might also be seen to overburden health care personnel, especially professionals who lack the relevant experience or training even on the e-basics. This, in turn, may well entail not only their hesitation to happily become involved with the new e-modi operandi, but also their possibly pointed aversion with overtly confessing any e-errors [11] within a range of new e-health care activities not readily acceptable as their mandatory function. In this light, it may also be suspected [12] that feelings of ambivalence might lead some to directly or indirectly complain about the e-conditioning of the new health era, and for this reason, at extreme ends, to even claim entitlement to e-err.

C. Theoretical Determinants

Psychological Hardiness (cf: resilience), as contrasted to Alienation, may be defined as the 'quality of success' in terms of three major cognitively tuned personality characteristics in balance: a) [self-] Control, the willful self-regulation aiming at self-effectiveness; b) Commitment, the conscientious devotion undertaking responsibility of one's own thoughts, beliefs, actions and emerging consequences, while respectfully considering the others' merits and potential benefit; and c) Challenge, the mindful management of both internal and external stimuli (cf. stressors), regardless of their perceptible positive or negative inkling, as opportunities for growth of both the self and an increasing number of important others gradually added to one's consideration. While the ideal spontaneous construction of these '3C's' in balance is fairly scarce and is found in a relatively low but stable 11% in the general population [13], [14], the real 'threat' for the self is identified within the group of the low, and/or distinctly imbalanced hardies, portrayed as prone to develop alienation attributes [15] – i.e., a way of thinking and acting 'in void', almost 'living by chance', deprived of the advantageous Hardiness characteristics as depicted – and tend to score low, and/or, most importantly, uneven scores at each of the 3C's when issued the pertinent questionnaire [16]. Hardiness is intrinsically a 'dichotomous' personality construct: it indicates inherent psychological health, or robustness, when its '3c's' are in high degrees *and* in balance, but it conveys alienation when imbalanced *or* selectively low [17]. Alienation implies nihilism, whereas Hardiness is synonymous with self-efficacy.

Burnout, on the other hand, may be described as the lack of effective coping against overtaxing demands because of the lessened 'self-and-other-and-future' appreciation, that progressively leads to physical, behavioural, cognitive and emotional disempowerment with a serious risk of exhausting, if not irreparably draining the individual. These complications may obviously constitute a threat for opening extremely costly vicious circles for both individuals and organizations [20], [21]. Burnout has long been recognized as a costly syndrome of psychosomatic disorganization mainly involving three compounds: a) Emotional Exhaustion, the accumulation of feelings of being emotionally overextended and exhausted by one's work; b) Depersonalization/Dehumanization, an unfeeling and impersonal response toward recipients of one's service, care treatment, or instruction, depleting one from the human essence of their vocational social interactions and c) [the impression of lack of] Personal Accomplishments, an emotionally anchored sense of dissatisfaction with one's endeavours along with impressions of incompetence and unsuccessful attempts to achieve goals within a work environment [22]. Of the most prevailing candidates for study in this context have been the health carers, as their everyday contact with the suffering is both chosen and extremely stressful.

D. Forming the Research Hypotheses

In the light of these tenets the hypotheses were tested that i) chiefly on correlational grounds specific trait dispositions,

namely, the Hardiness-vs-Alienation personality construct, might relate to, and probably clarify the resistance-vs-proclivity to make e-errors and, ii) at optimal levels (i.e., hardiness) operate as resilience source in the encounter of high e-pressures experienced in the hospital lab, whereas at lowest levels (i.e., alienation) function as a predictor of the risk of, not only making such e-errors, but also leading to burnout due to lower coping ability of individuals to handle occupational, especially e-stressors

E. Hellenic Particularities

In these respects it may be safely argued that the present work represents the first major attempt at a national Hellenic level to assess the possible effects of personality for erroneous computer entry problems / e-errors in laboratory information systems (LIS) by hospital staff rightfully involved in e-recordings; i.e., specialized nursing staff, expert laboratory technicians and lab physicians. Evidence on the Hellenic hospital carers' susceptibility to burnout has been sufficiently provided in the past [23], and proof of the potential correlation of Burnout and Hardiness has been presented in several international accounts [24]-[27]. But little attention has been given to such correlational possibilities with regard to Hellenic hospital carers – let alone the minimal attention paid to examining e-errors in the same context, indeed, by linking them to either burnout vulnerability, or hardiness personality possible weaknesses.

II. METHODOLOGY

A. Antecedents:

i) Theme justification via cost-relevance inferences

Firstly, a comparison was made of an indicative sample of 2540 electronic files to the corresponding cases' hard copies in the laboratories of two Hellenic rural hospitals remaining on duty throughout the year (1270 files from each hospital). It was found that e-errors accounted for some 30% of the cases – in sharp contrast to other international measurements reporting an average of 10%, e.g., [6]. The expenditure rate of such Hellenic lab e-errors in terms of the net cost of their occurrence was then calculated, and reached an annual approximation cost of €281,000.00 per urban Hellenic hospital. The average added cost of the main consequences of the lab e-errors recorded was also calculated, by taking alternatively into account: (a) costs of repetition of various examinations, (b) costs of unnecessary examinations, (c) cost of changes in the pharmaceutical prescriptions as well as (d) cost of the multiplication of consumption of lab reagents – dimensions, that were selectively corresponding to the cases accounted for. It was revealed that the rising cost gets almost to the double of the initial gauge, thus reaching an annual potential amount of some additional €217,000.00 per hospital. *Approximately €498,000.00 may be therefore safely said to overburden each rural Hellenic hospital's budget each year due to mere faulty e-entries.*

With most associated parameters considered (multitude of health care provisions, follow-up costs, currency analogies, etc), this amount might rise to be comparable to estimations of

other national partial damage accounts, e.g. [7]. Notably, other indirect qualitative e-error related costs, such as the patient waiting list or the staff time consumption, were not accounted for {see also [18] and [19]}, due to the indicative nature of the measurements taken. Yet in this way an empirical basis of cost-related indicators was fairly established, justifying the interest in exploring the issue of e-errors, indeed via possible personality determinants, inasmuch as erroneous computer entries do constitute a truly high figure worth considering for further investigation. Should this condition be satisfied, as it was, it would then be possible to proceed in an attempt to isolate the plausible factors, which, once ascertained, would be treated as causative incentives likely to be ameliorated by intervention – hence enabling future management to act proactively towards minimizing and even eliminating errors and costs together.

ii) Measures delineation via pre-pilot deduction

Since the investigative approach adopted in this study of personality Hardiness on e-error occurrence was novel for at least Hellenic hospital labs, a certain number of scales were then constructed with intent to highlight specific issues relevant to e-use and its erroneous aspects in the hospital laboratory. These scales are described below.

actual e-use indicator

Because empirical observations and certain official reports as, e.g., [4], tend to reveal limited e-use for sorting out patient records in rural hospitals of Hellas it was necessary to determine the actual breadth of e-practice performed for this purpose. A checklist of 80 lab-related e-tasks were initially put into test in order to single out the ones most commonly carried out by the Hellenic hospital laboratories personnel. Seven items surfaced from this factorial account and were used accordingly.

e-stressfulness due to e-use scale construction

Emerging from the former, a 30-item scale was developed to tackle any stressfulness that might surface in the target sample due to the actual e-use in the hospital lab environment. Analyses produced a final 7-item scale, answers in which would directly indicate any unease with mandatory and even optional e-functions in the lab.

e-error size-up checklist construction

Deciphering from tasks on every step of the typical e-recording processes, as these emerged from the match on actual e-use routinely assumed in the Hellenic hospital labs, an initial checklist of 50 'e-mistakes' was univariately created and multiply regressed taking into account their quantitative consequences. The model was chosen by picking the variables from the list of the typical e-recording requirements (mandatory/'unavoidable' vs elective/'avoidable' via paperwork), the e-practices actually performed and several ad hoc measurements of the more costly ones in case of mistake, based on the four aforementioned cost tallies. Starting with all variables univariately significant and using stepwise selection to include all e-mistakes of the highest likelihood 12 items surfaced to comprise the scale. As noted, qualitative considerations such as time lapses, or patient or staff quality of

life affected by e-errors were not taken into account, mainly because of the pilot character of the study.

e-error attribution scale construction

Following the 2001 meticulous work of Stordeur issues on: high workload; inter- and intra professional conflict with an emphasis on lab e-functions; confusion due to lack of job description clarity especially about e-use and e-responsibilities; and various intermediate e-error detection-vs-correction tactics; were all covered [28]. This was achieved by constructing an e-error-attribution scale, the 25 items of which were loaded on three factors: a) [own-vs-others] e-knowledge (in)sufficiency, b) institutions' technical (in)sufficiency plus e-workload burdens on oneself vs others and c) [own-vs-others] social (lack of, and conflict in) support. Based on assertions of cognitive error causality for adults, as in, e.g., [1], [29], the reflection of one dimension that implies internality, complemented by one dimension that implies external causation for each factor, seemed to fit the target sample profile in order to function as a dichotomous measure that would highlight inclinations to either attribute problems to, and admit responsibility on e-errors of the self, or the 'others'.

A certain number of scales were then constructed with intent to highlight specific issues relevant to e-use and its erroneous aspects in the hospital laboratory. These included: (a) an *actual_e-use indicator checklist* of 80 items; (b) a 30-item *e-stressfulness due to e-use scale*, emerging from the former, as based on the 80-item pertinent *actual e-use* measure; (c) an *e-error, 50-item checklist*; (d) a 25-item *scale on e-attributions* measuring tendencies to 'blame' one's erroneous computer use on either external or internal factors perceived as responsible for e-error occurrences; and (e) a variation of a standard demographic checklist including additional items concerning several time aspects with respect to obligatory vs optional e-use of lab pros.

iii) Standardization of Auxiliary Scales

One hundred and forty (N=140) lab pros (70 males and 70 females) were consecutively approached so as to evaluate these initial measures at a pre-pilot stage of the study, and after appropriate elaboration the finalized scales emerged as described in the Instruments section, below. Lastly, the final battery of the emerging measures was assembled and issued to the target group of the Hellenic rural hospital lab pros.

B. Main Study

i) Sampling

Two hundred and seventy-six (276) laboratory personnel of seven (7) Hellenic public rural hospitals on constant duty throughout the year were randomly approached during February of 2007² and asked to participate in the project. Of the 272 who accepted to participate, some 270 (N) valid protocols were finally (April '07) received from 153 women (56.6%) and 117 men (mean age 39,8; SD 7,9). These individuals were mainly laboratory expert technicians (N=117; 43,3%) and medical personnel (N=117; 43,3%) rightfully

involved in laboratory functions (e.g., microbiologists) as well as laboratory experienced nursing staff (N=36; 13,3%).

These percentages are quite representative regarding the actual numbers of staff involved in the Hellenic hospital laboratories nationwide, wherein nursing staff is always outnumbered by expert lab technicians and lab doctors. Also, due to the psychological nature of the study, over-sampling doctors and expert lab technicians would not present any problem, especially taking into account that the hardiness research uniformly [24] asserts typical demographic characteristics (gender, status, income, age, years of experience, number of dependents) not to significantly correlate with its 3C compounds. Urban hospital lab personnel were excluded at this phase of the research project on the basis of their more complicated lifestyles, extra everyday burdens and/or stressful life events and, possibly, increased resourcefulness and human power regarding demands on e-use as compared to their Hellenic rural counterparts. It was thought that the very satisfactory actual participation rate along with the marginal missing values recorded in the issued questionnaire protocol were chiefly due to the combination of three main appealing features of it: a) its overall innovative nature, b) its explained emphasis on psychological features and c) its subsequent quality of offering a chance to 'learn something new about the self' by merely getting involved with answering.

ii) Instruments

Hardiness was assessed by a modified and translated version of a leading measure on personality, the Personal Views Survey-II (PVS-II) – an originally 50-item self-report questionnaire [17], [30] comprised by its three subscales; namely, Control, Commitment, and Challenge (the '3C's'). Each item is a statement reflecting realistic dimensions of cognitively mediated coping qualities at which respondents mark their views on a 5-point Likert-type scale ranging between 1 (hardly descriptive of me) to 5 (fully descriptive of me). Sample statements from the Hardiness questionnaire include 'I often wake up eager to continue my life where I left it the day before', and 'I feel uncomfortable if I have to make changes in my everyday schedule'. High, but also balanced scores on the scale highlight ideal personality qualities proven to buffer stress, anxiety, and illness concomitants. The scale has shown satisfactory internal reliability (.77-.84 for Control, .78-.81 for Commitment, .69-.71 for Challenge and .83-.89 for total Hardiness) and validity (.89 for control, .86 for commitment, .80 for Challenge and .83 for total Hardiness) – values, that applied for, and were also exceeded at the modified Hellenic version [23]. After calculating appropriate reversals, the scale provides a high total score for Hardiness versus a low total score for Alienation. Extremes in any of the 3C's do not imply some advantageous personality profile; rather, imbalance is suspicious of dysfunctional cognitive schemata to the extent of alerting for psychological aid necessity.

Burnout was measured using the well-known [31] Maslach Burnout Inventory (MBI) consisted of its three subscales;

²A time, marked by the preceding period of major e-provisions to the rural Hellenic hospitals.

namely, Emotional Exhaustion, Depersonalization and [sense of lack of] Personal Accomplishments (here also abbreviated as 'NoGain') – *the latter being taken inversely accounted for*. The Cronbach's alpha for each in the current study was .87, .72 and .63, respectively. It is the 22-item, 7-level Likert type set of statements answered by markings from 0 (never occurring to me at work) to 6 (occurring to me everyday at work). Sample statements from the Burnout questionnaire include 'I deal very effectively with problems people bring me at work' and 'I feel used up at the end of the day'. The MBI has been widely issued and regarded as a fairly dependable instrument, albeit mainly because '...the measure is both well developed and well understood...' [32], with a 'relatively high internal consistency and test-retest reliability...' [33], though adequately satisfying evidence for it have not been published [34]. Since the causative factors identified for burnout are versatile, including a) job & role characteristics, b) personal characteristics and c) organizational characteristics (idem), chiefly the latter of which be admittedly its strongest feature [20]; since certain findings [35] draw attention to notable, yet undervalued, sub-dimensions in the original subscale of the [sense of lack of] Personal Accomplishments [i] perceived achievement and ii) professional efficacy]; and since some other findings strongly suggest necessity for alterations such as the deletion of certain items [36], [37]; it was here deemed preferable to refrain from summing up the 3 MBI subscales towards a total scoring.

A typical demographic checklist enriched with several items on time aspects of the target samples' lives regarding e-use was issued to record status, socioeconomic and family basic information along with a measure on *Actual e-use* as marked on a 7-item check-scale (Cronbach's alpha .80) investigating the e-actions essentially taken by the members of the sample for sorting out patient records during their everyday practice.

e-Stressfulness due to e-use was a 7-item (Cronbach's alpha .80) product-scale based on the *Actual e-use* measure following typical math steps [38] and phrased appropriately to exert any discomfort with the actual e-workload.

e-errors were sized up in accord with [39] by a 12-item checklist (Cronbach's alpha .77) of major costly mistakes resulting from an initial account of 50 as the most likely to occur in Hellenic hospital laboratories during e-recordings.

E-error attribution was determined by the use of the factor analyzed 14-item scale (Cronbach's alpha .86) out of the 25-item initial scale specifically constructed for the needs of the current research, and in accordance with the 2001 work of Stordeur and colleagues [28], who stressed the importance of similar factors to the ones here attempted to be developed: Scores would capture external vs internal attributional tendencies regarding stressful factors that may emerge from e-recordings related to the sample members' lab working conditions, subjectively thought of as being 'responsible' (or not) for their e-errors on three counts/factors: a) [own-vs-others] e-knowledge (in)sufficiency, b) institutions' technical (in)sufficiency plus e-workload burdens on oneself vs others and c) [own-vs-others] social (lack of, and conflict in) support. High scores on this measure would point toward external

attribution style with implications on external locus of control and indications of unwillingness or powerlessness in dealing with laboratory e-stressors.

III. ANALYSIS OF DATA

The statistical analyses were performed by use of the SPSS v15.0 for Windows in combination with Excel for Windows. Frequency and percent distributions were used to present the demographic as well as major psychological characteristics of the participants. All Likert-type answers were appropriately transformed for homogeneity. The main research question was tested by using the Pearson's product moment correlation to determine two major subject matters: a) the nature and magnitude of any significant association among scores on the two key-measures of Hardiness and Burnout on the one hand, and scores on i) the e-error dimensions (e-stressors, e-errors admitted, plus e-error attributions) and ii) the Time dimensions involved in the course of the lab pros' lives on the other; also, in order to outline the 'greater picture': b) the nature and magnitude of any significant relationship between scores on the e-error dimensions on the one hand, and scores on both, each of the 3 Burnout subscales [emotional exhaustion, depersonalization, and (lack of) personal accomplishment] and each of the Hardiness 3C's along with the total Hardiness score on the other. To determine whether the latter would predict the former as well as the possible erroneous e-use by participants, standard linear and multiple regression analyses would be performed. Because Hardiness ought to be conceptually perceived as a dichotomous construct, any analyses of variance products with reasonably large degrees of freedom would be acceptable, while repetitive clustering corroborated by fitting squared semi-partial correlations (semi-splits) would highlight any fine distinctions. Provided that the study had a pilot character and the sample was relatively small and for the first time presented with a questionnaire of this caliber, the analyses would suffice for making necessary primary inferences as to both, any critical needs emerging for aiding the lab staff, and possible future research directions to be followed. For these reasons, though, two additional measures were taken: a) supplementary cluster and factorial analyses would be performed with intercultural considerations in mind and b) a 0,01 level of significance was established for making major inferences – though by support of certain connotations [40], a 0,05 level of significance was also decided to selectively be taken into account.

IV. RESULTS

A. Demographic Characteristics of the Sample

As noted, the sample, consisting of 153 women and 117 men (N=270) with a mean age of 39,8 years (SD 7,9), were rural Hellenic hospital laboratory professionals of three distinct levels of rank, namely, nursing personnel, expert lab technicians and lab doctors – all being on-call throughout the year and all entitled to potentially use electronic means for lab-related patient file recordings. Most participants (59%) were 37 to 47 years old, and 1/3 of them were married. Their

mean number of years of service in this specialty including any training time prior to their official enrollment was 11,03 (SD 7,16). All held at least a degree in their field (if in nursing, an associate, or bachelor's degree or higher), and most (68%) held a postgraduate title/qualification. The majority of the sample (68,3%) indicated that basic electronic equipment had already been available to them in their working environment for a mean of 7,30 (SD 6,14) years, nevertheless their own involvement in using it did not exceed the mean of 3,15 (SD 1,5) years, but their extra-professional (possibly leisure) e-use appeared to be only marginal by a mean of 4,37 years, but with a wide SD of 4,88. Yet, participants almost unanimously reported quite high levels of stressfulness due to this e-use (Mean 3,77; SD 1,02). On the other hand, despite the fact that these lab pros overtly reported minimal (Mean 1,79; SD 0,54) e-errors ('e-errors admitted') with this variable seen (below) to correlate poorly with most other variables except for Hardiness Control and Burnout Depersonalization, however, the pertinent line of questions referring directly to the very causes they thought were responsible for their e-mistakes ('e-error attribution to stressors') was both, highly scored (Mean 3,89; SD 0,81), thus suggesting external locus of control in the majority of participants, and highly correlated with a number of variables, thus denoting a discrepancy – if not a hasty tendency to defend oneself against assuming responsibility of one's own actions. All participants without exception indicated that they were actually involved in all the basic e-functions included in the actual e-use checklist. Demographic sample characteristics can be seen summed up in Table I–A.

TABLE I – A
DEMOGRAPHIC SAMPLE CHARACTERISTICS:
FREQUENCY/PERCENT DISTRIBUTIONS

Sample characteristics: <i>Demographic features</i>	Mean	SD	N/ Valid
♀ 56.6%/N=153 [+♂117]; N=70 married			270
Age (SD)	39,8	7,9	270
Dependents at home (min.=0; max.=4)	1,25	1,07	270
Years of study in this specialty	5,03	2,60	270
Enrolled as hospital staff: 'Time (yrs) in this job'	11,03	7,16	270
Time (yrs) of (any) special e-studies (M71)*	0,25	0,77	199
Time (yrs) of (any) non-professional 'e-use' (M54)*	4,37	4,88	216
Time (yrs) of e-equipment available at this job (M77)*	7,30	6,14	193
Actual e-applications/'e-use' at this post held in lab	3,15	1,05	270

*(M) = Missing ; **(A) = Average Score

B. Psychological Characteristics of the Sample

The vast majority of the sample suffered burnout at distressing percentages: In sum, 72% (N=194) experienced sharp emotional exhaustion, 66% (N=177) heightened depersonalization and 67% (N=181) pointed lack of satisfaction with their personal accomplishments ('no-gain'). At the same time, their hardiness profile appeared to be rather

fragile: although in arithmetical terms of Means the sample seemed reasonably balanced albeit still mediocre as reflected in their numerical total hardiness score, however, a closer look at the formation of their hardiness profile revealed some worrying aspects. Tight standard deviations already uncovered a high concentration of the participants in the subcategory of the 'medium hardies' cluster, at least in the case of Control and Commitment, whereas a raised degree of Challenge did not appear promising for inner equilibrium in the same individuals. In addition, clustering and factor analyzing hardiness for this particular group of participants appeared to mathematically 'force the limits' of both optimal mid cut-off points of the 3C's subscales and the total hardiness score (i.e., between low and medium, and between medium and high hardiness), thus in a way merging normative categories in order to foster marginal cases. The latter, and despite the wide breadth of fine fluctuations within each subgroup ('lows', 'mediums', and 'highs'), yet also maintained large distances from cases allocated in the next neighbouring cluster (more than .25 each time), thus creating unexpected 'gaps' between clusters. This was not only an interesting supplementary empirical indication of content validity and even internal consistency of the hardiness psychometric instrument within the specific Hellenic cultural context; it also signified certain potential idiographic characteristics of the laboratory groups examined, who, in turn, might be needful of immediate psychological attention. Though similar 'gaps' between cut-off points were observed in the Burnout dimensions, this observation did not apply for the rest of the scales. Table I–B shows the main psychological characteristics of the sample of the lab pros studied here.

TABLE I – B
PSYCHOLOGICAL SAMPLE CHARACTERISTICS:
FREQUENCY/PERCENT DISTRIBUTIONS

Sample characteristics: <i>Psychological features</i>	Mean	SD	N/ Valid
Actual e-stresses: i.e., Stressfulness due to e-use	3,77	1,02	270
e-errors admitted	1,79	0,54	270
e-error attributions: <i>to external stressors</i> ('blame')	3,89	0,81	270
Control 58,9 (A)** : (≥89-80)***	3,28	0,46	270
Commitment 58,6 (A)** : (≥89-79)	3,26	0,73	270
Challenge 53,8 (A)** : (≥69)	3,85	0,50	270
Hardiness Total 57,3 (A)** : (≥83)	3,43	0,45	270
Emotional Exhaustion 22,8 (A)** : (≥27)	2,53	1,35	270
Depersonalization 9,7 (A)** : (≥10-13)	1,93	1,23	270
Sense of no success/'no-gain' 33,9 (A)** : (≤31-33)	4,23	0,93	270

*(M) = Missing ; **(A) = Average Score;
***: (≥, or ≤): as compared to maximum expected value

A word of caution is necessary at this point. Merely considering the classic burnout cut-off points between degrees of severity for each subscale might not suffice here. A degree just above average / 'middle third' cut-off margins of the Burnout estimates was reflected in the average scores of the lab participants for all three Burnout subscales. These scores

may be taken face-value and regarded as such, i.e., moderate, if weighed up against fixed expectations of the assumed general intercultural accounts. However, *they might be interpreted as even disturbing if considered in a firm Hellenic cultural context, wherein a number of complementary resources are supposed to exist in favour of the lay-person in everyday life (strong social support, close family ties, dependent -hence relaxed- national economic affairs, etc).*

Likewise, to ponder into the sample's personality qualities, a degree just above average /medium Hardiness cut-off margins of the Hardiness estimate was also reflected in the average scores of these lab respondents for all 3C's along with the total Hardiness score. Again, *this could be tolerable if considered by mere culture-independent numerical comparisons, but it should be deemed seriously low, indicating a grim Alienation nuisance if viewed under the light of the Hellenic culture, still allegedly empowering its members via historical, religious and political connotations.*

C. Burnout by Staff Rank in the Hospital Lab

The sample profile may be further exemplified if looked at in terms of rank. Contrary to expectation [32], the lab nursing staff seemed more relaxed. Distinctly higher Burnout levels were observed for both lab doctors and lab experts. Table II provides information on the degree of severity of Emotional Exhaustion in all lab personnel classified by rank. Increased numbers of pros leaned to 'worrying' and 'serious' Emotional Exhaustion. *Persons higher in the rank showed greater propensity to be emotionally drained in their chosen workplace. It could have been assumed that either due to their longer involvement, or their always being outnumbered (perhaps instructed too-cf.: 'ordered-around') by highly qualified seniors (lab experts, doctors), lab nurses might be expected to display more emotional fatigue: Yet, this set of data from these particular lab nurses shows quite the opposite.*

TABLE II
EMOTIONAL EXHAUSTION BY RANK IN THE HOSPITAL LAB

EMOTIONAL EXHAUSTION BY RANK IN THE HOSPITAL LAB								
Degree:	Inconsequential	Low	Moderate	Worrying	Serious	Alarming	N	
RANK	NURs	0,0%	0,0%	2,2%	2,2%	4,4%	4,4%	36
	LABs	2,2%	6,3%	6,7%	4,4%	10,4%	13,3%	117
	DRs	0,0%	6,3%	4,4%	15,6%	10,7%	6,3%	117
TOTAL N:	6	34	36	60	69	65	270	

Table III illustrates the distribution of Depersonalization tendencies of the lab staff by rank. Again, staff of highest positions experienced more Depersonalization symptoms, at 'serious' and 'alarming' degrees. Lab technicians seemed to suffer such self-estrangement signs to a greater extent (a total of 23,7%). While doctors were fairly close (26,3%) at a somewhat lesser risk, this could be for different reasons, given that the quality of Depersonalization is highly idiographic and

by definition might involve different motives, thoughts and (lack of) incentives for different individuals.

TABLE III
DEPERSONALIZATION BY RANK IN THE HOSPITAL LAB

DEPERSONALISATION BY RANK IN THE HOSPITAL LAB								
Degree:	Inconsequential	Low	Moderate	Worrying	Serious	Alarming	N	
RANK	NURs	0,0%	2,2%	2,2%	2,2%	4,4%	2,2%	36
	LABs	0,0%	8,5%	4,4%	4,1%	13,3%	13,0%	117
	DRs	1,9%	6,7%	8,5%	10,7%	13,3%	2,2%	117
TOTAL N:	5	47	41	46	84	47	270	

Similar trends are seen in Table IV, with pros higher in rank piled into 'worrying' and 'serious' levels of the lack of sense of success/'no-gain' in their endeavors.

TABLE IV
NO SENSE OF SUCCESS / NO GAIN BY RANK IN THE HOSPITAL LAB

NO SENSE OF SUCCESS BY RANK IN THE HOSPITAL LAB								
'NO-GAIN' Degree:	Inconsequential	Low	Moderate	Worrying	Serious	Alarming	N	
RANK	NURs	0%	2%	2%	7%	2%	0%	36
	LABs	9%	7%	2%	9%	17%	0%	117
	DRs	0%	9%	2%	15%	13%	4%	117
TOTAL N:	24	47	18	82	87	12	270	

Once more, in view of this data set any presumption that would have presented this variable as possibly irrelevant to this humanitarian service provision profile should be dismissed: lab experts (26%) and lab doctors (28%) do experience dissatisfaction with their work and discontentment with their own endeavors in it, to a heightened level than either thought of, or shown by similar past studies [23].

D. E-errors versus e-attributions ('blame') by Staff Rank in the Hospital Lab

These people do e-err, and as the e-errors they overtly reported seemed to decrease in frequency when severity increased, it is then that these lab pros tend to be more accusatory of external deficiencies leading them to commit such e-errors. Seen in juxtaposition, the e-error-versus-blame account (Table V) uncovers critical discrepancies. When the overtly reported e-errors were admitted to a low frequency, the matching for external attributions appeared similarly low, indeed at an understandable rate if some pros are to be seen as maturely accepting responsibility. In contrast, *when the overtly reported e-errors were stated at higher rates, it was then that the matching attributions to external factors increased disproportionately, making 'blame' be noticed as 'more' than the very e-errors committed. Table V illustrates these inconsistencies.*

TABLE V
E-ERRORS VS E-ATTRIBUTIONS BY RANK IN THE HOSPITAL LAB

E-ERRORS VS E-ATTRIBUTIONS BY RANK IN THE HOSPITAL LAB							
Degree:							
		FEW		MODERATE		GRAVE	
'e-blame'		e-ERR	e-BLAME	e-ERR	e-BLAME	e-ERR	e-BLAME
RANK	NURs	9%	2%	4%	4%	0%	7%
	LABs	20%	4%	19%	21%	4%	17%
	DRs	20%	9%	21%	24%	2%	10%
TOTAL %		49%	15%	44%	49%	6%	34%
TOTAL N:		130	41	122	136	18	93

To make e-errors vs e-attributions ('e-blame') by rank in the Hospital Lab: Most e-errors are overtly reported at the minimal level, but most attributions to external factors 'causing' such e-errors are unduly connected to the moderate and severe levels.

Here too, the nursing staff appeared over-conscientious or more detached (?), as to their role in this affair, while the other two categories of the lab pros appeared more involved with ideas of identifying external factors to excuse or explain e-errors. Curiously, the correlation matrix showed a strong negative association between e-errors and e-blame ($r = -.296$, $P < .001$): an association, fairly suspicious of differential causes for each.

E. Hardiness by Staff Rank in the Hospital Lab

It is important to observe the Hardiness evidence as examined by rank in this sample. Extreme scores in the Hardiness vs Alienation dimension were neither in the total, nor in the partial scores necessarily promising for portraying a balanced personality profile. Extremities in Hardiness scores often warn of alarming inconsistencies that may even alert for psychopathological signs in individual profiles. By majority the hospital lab personnel appeared to be fairly in self-Control (Table VI), somewhat crumbled with regard to Commitment (Table VII), but also quite confused as to the Challenge quality (Table VIII). Evenly distributed, staff at all ranks seemed at high personal Control by just 2%, while a considerable 17% of them exhibited very low self-Control – a finding, which was not so encouraging if one thinks of the choice they have made themselves in serving at this particular lab post they held (Table VI).

TABLE VI
THE HARDINESS COMPOUND OF CONTROL BY RANK IN THE LAB

CONTROL BY RANK IN THE LAB					
Degree:					
		LOW's	MEDIUM's	HIGH's	N
RANK	NURs	2%	9%	2%	36
	LABs	7%	34%	2%	117
	DRs	9%	33%	2%	117
TOTAL %		17%	76%	7%	100%
TOTAL N:		47	205	18	270

The members of this sample behaved differently when Commitment was measured, with a unsettling 15% of the lab experts being low and with an equally unsatisfactory 22% of

their peers and lab doctors marking high scores in this Hardiness dimension (Table VII).

TABLE VII
THE HARDINESS COMPOUND OF COMMITMENT BY RANK IN THE LAB

COMMITMENT BY RANK IN THE LAB					
Degree:					
		LOW's	MEDIUM's	HIGH's	N
RANK	NURs	4%	9%	0%	36
	LABs	15%	19%	9%	117
	DRs	0%	30%	13%	117
TOTAL %		20%	58%	22%	100%
TOTAL N:		53	157	60	270

Though Challenge appeared to be the quality that 'keeps them at work' by 63%, still, lows and mediums border on their high counterparts, thus presenting a blurred picture of both motives and potential (Table VIII). Doctors seemed surely more Committed to service provision, but Commitment per se did not appear to constitute the quality that sustains vigorous lab functions on their part.

TABLE VIII
THE HARDINESS COMPOUND OF CHALLENGE BY RANK IN THE LAB

CHALLENGE BY RANK IN THE LAB					
Degree:					
		LOW's	MEDIUM's	HIGH's	N
RANK	NURs	2%	7%	4%	36
	LABs	4%	13%	26%	117
	DRs	7%	4%	32%	117
TOTAL %		13%	24%	63%	100%
TOTAL N:		36	65	169	270

Indeed, the broad estimate of an 11% in the general population being spontaneously high hardies is overcome by this particular group of pros, and nearly as expected, the high's percentage reached 20% (Table IX). Nonetheless, given their professional choice having been made willfully, this figure would at least in theory be hoped as even higher, with the partial profiles of the 3C's even more balanced.

TABLE IX
THE HARDINESS PERSONALITY CONSTRUCT BY RANK IN THE LAB

TOTAL HARDINESS BY RANK IN THE LAB						
Degree:						
		LOW's	MEDIUM's	HIGH's	N	%
RANK	NURs	2%	11%	0%	36	13,3%
	LABs	2%	33%	9%	117	43,3%
	DRs	0%	32%	11%	117	43,3%
TOTAL %		4%	76%	20%		100%
TOTAL N:		12	205	53	270	

Although the total Hardiness scores appeared satisfactory given the identity and history of choice of these health pros, yet a closer look at their 3C's composition revealed some discrepancies that were also intensified by certain extreme scores, suspicious of internal imbalances. These discrepancies were also reflected at their e-errors profile and their burnout

proclivity, hence underlying the grave importance of studying the descriptive measures in this context: Actually, these findings may already prompt for offering support to these pros with a view to advance their personality disposition in order to facilitate coping with especially the hospital e-stressors that burden and weaken their strengths.

F. Correlational and Regression Analyses

The correlation between Hardiness and Burnout scores was highly significant (at the 0.01 level) throughout most of the key subscales involved. The only exception was observed in the relationship between the Hardiness Challenge compound and the Burnout Emotional Exhaustion scale which appeared to be negative, as expected, but inconsequential, perhaps exactly because these two qualities should, in theory, be proved to be irrelevant rather than contradictory (for a rather philosophical theorizing of this issue see [15]). Table X presents the set of these relationships:

TABLE X
PEARSON PRODUCT MOMENT CORRELATIONS FOR HARDINESS AS RELATED TO BURNOUT

	CORRELATIONS OF HARDINESS TO BURNOUT			
	HARDINESS TOTAL	CONTROL	COMMITMENT	CHALLENGE
EMOTIONAL EXHAUSTION	-.425(**)	-.377(**)	-.363(**)	-.002
	.000	.000	.000	.980
DEPERSONALIZATION	-.392(**)	-.168(**)	-.524(**)	.143(*)
	.000	.006	.000	.019
SENSE OF 'NO-GAIN'	.348(**)	.302(**)	.198(**)	.193(**)
	.000	.000	.001	.001

**p <.01 // *p <.05

The higher the hardiness scores, the less the burnout symptoms experienced by the hospital lab respondents – indeed, regardless of their position in the rank. This suggests that there is a strong relationship between the two constructs and might introduce a need to more carefully examine their interplay in the future. That Challenge correlated to Depersonalization in a positive significant mode albeit low for the standards of the current study ($P=.05$) still has to be seen as a notable finding only if one is reminded [16] of the theoretical determinants of Challenge enabling the individual to surpass certain trivial everyday occurrences in order to identify purpose in action. In the same light the high positive relation of Challenge to the 'No-Gain' variable must be interpreted, since it is the inherent sense of interest to one's own activities that nullifies self-worthlessness.

It should also be noted that as hypothesized low Hardiness, i.e., the quality that signifies Alienation tendencies explains much of the variance for all three burnout dimensions, and not vice versa: the r^2 reached .73 ($F=69$ $df=1$, $P=.00$) for emotional exhaustion, .67 ($F=54.2$ $df=1$, $P=.00$) for depersonalization and .78 ($F=61.7$, $df=1$, $P=.00$) for the low sense of accomplishment.

G. Age of lab staff vs Hardiness and Burnout

Despite strong indications to the contrary [41], it still remained essential to determine any relationships of Hardiness to the demographic characteristics of the sample. No significant differences were revealed between the sample's 'standard' demographic characteristics on age, sex, income, hierarchical status in the lab, marital status and number of dependents at home for scores on 3C's, thus verifying the Hardiness strength as an evaluative measure for accounts on personality potential. A post hoc Scheffé test was however conducted to determine any difference among specific age groups in the Hardiness scores, where a marginal negative association attracted some attention, as it was revealed that younger staff tended to exhibit lessened vigour in Control and Commitment, yet an intensified dynamism in Challenge – but with analogous behaviors developed in relation to their denial to assume responsibility over committing e-errors and to their readiness to external attributions to such e-errors. Amid all perils of categorization on continuous variables [42] a post hoc Scheffé test also offered clarification to a marginal negative association of age to the Burnout 'No-Gain' dimension, revealing some tendency of younger lab staff to be easily satisfied with the worthwhileness of their accomplishments. In fact, this finding came as a surprise with regard to the early 1993 Gatz and Karel, as well as to the recent 2004 Aldwin and Gilman assertions that internal attributions increase up to the middle age and decrease subsequently [43], [29]. Taken together, these indications may reinforce the need to prioritize support to the younger groups of lab staff. The illusive contrast in the latter being of a marked disposition to present e-stress- and e-error- 'immunity' and at the same time a heightened susceptibility to Alienation may be explained by the fact that Hardiness was here measured as spontaneously developed in the individuals and a certain incoherence owing to inner imbalance reflects a need of systematic approach to regulate it.

H. Time Aspects of the Study – An Emphasis on E-Use

Interestingly, every single Time aspect as mathematically adjusted for compatibility and as cross-examined against Hardiness appeared meaningful. More specifically, Time (in years) spent in Service provision at the lab, Time in Study on one's specialty, Time of extra-professional e-use, Time in (any) special/apt e-studies, and Time of e-use in the current post were all checked for relevance to Hardiness. Table XI presents the Pearson's product moment correlations between these Time aspects and Hardiness. Time in Study on one's specialty was strongly and positively associated with especially the Commitment and the Challenge dimensions (obviously because Control pertains to core personality features that would remotely navigate, and only indirectly relate to 'surface' activities), indicating a brisk involvement with studies, that promises both responsible and creative self-elaboration. Time of extra-professional e-use was found to invariably correlate with all the 3C's in a strong positive way, indeed. explained by the Hardiness compounds in the regression level (total Hardiness $r^2=.74$; $F=36.8$, $df= 1$, $P=$

.001). This finding supports the notion that if boosted, Hardiness characteristics may motivate lab pros to become more actively involved in familiarizing themselves with the necessary issues pertaining to lab information technologies and in acquiring the necessary skills to effectively use them. In the mean time, Challenge was the dimension that 'made the difference' for both Time devoted for special/apt e-studies, and Time of e-use out of work, hence further strengthening the same notion. The strong negative correlation of Challenge with Time of e-use in the current laboratory post that these pros held appeared to reflect the high hardies' resistance to monotonous functions entailed in lab e-use, apparently balanced by Commitment prompting them to keep up with such functions. Also, an important finding is the highly significant positive correlation of Control to the actual e-stressfulness factor. According to the Hardiness theory [44], stress, any stress, is treated by the high hardies as an opportunity for growth rather than as some unwelcome occurrence, and high hardies were here consistently responding to the e-stressors measured.

TABLE XI

PEARSON PRODUCT MOMENT CORRELATIONS OF HARDINESS TO TIME ASPECTS AND TO ACTUAL E-STRESSES

CORRELATIONS OF HARDINESS TO TIME ASPECTS AND E-STRESSES						
	T(yrs) In This Job	T of study On One's Specialty	T of e- use out -of-job	T of (any) apt e-studies	T of e-use at this job	Actual e- stresses
HARDI NESS	-.331(**)	.313(**)	.357(**)	.056	-.016	.076
	.000	.000	.000	.429	.822	.215
CONTROL	-.173(**)	.029	.191(**)	-.113	.046	.167(**)
	.004	.647	.005	.112	.525	.006
COMMIT MENT	-.226(**)	.368(**)	.318(**)	.060	.176(*)	-.043
	.000	.000	.000	.397	.074	.481
CHAL LENGE	-.323(**)	.142(*)	.268(**)	.142(*)	-.270(**)	.082
	.000	.024	.000	.046	.000	.177

Pearson product moment correlations for Hardiness to all Time (T) aspects adjusted: Time in Service, Time in Study, Time of extra-professional e-use, Time in (any) special/apt e-studies, Time of e-use in current post, plus Actual e-stresses at work

**p < .01 // *p < .05

That the increased Time in service correlated negatively to Hardiness is not to be interpreted as some supposed personality 'weakening' evidence: Although consequent regression analyses did not provide any satisfactory clarification either way (at best, Hardiness tended to explain rather than being predicted by, such a time aspect as the duration of service provision at a level of 14%), this finding does seem important: Given that, as mentioned above, Hardiness was measured in this sample as it has spontaneously been formed (i.e., without any prior systematic intervention to boost it), those of the sample – alas, still very few – who happened to have enjoyed more creative, bread-winning burden-free, academic time might have had some better prospects of introspection, hence the chance to elaborate and improve their inner qualities. However limiting this might

appear in a broader context as to concepts about equal opportunities, it may be deemed as probable, chiefly considering the equally meaningful, exclusively negative correlations formed among the same Time aspects and the Burnout dimensions, presented hereafter.

Table XII displays the Pearson's product moment correlations between Burnout and the Time aspects studied here. Being busy with obtaining academic qualifications, extra-professional (possibly leisure-) e-use, and with activities linked to added e-knowledge acquisition does seem important to shield against symptoms of Burnout – plus propel fewer attributions to external faults (as observed in the pertinent correlations of e-errors admitted, and attribution tendencies). Emotional Exhaustion and feelings of 'No-Gain' in one's lab work environment increase as time goes by in routine engagements, while actual e-use at work excludes the incidence of Depersonalization to some considerable extent. Again, consequent regression analyses did not provide any satisfactory clarification either way, except for the dimension of decreased 'No-Gain' that was slightly explained by extended study duration at 16% of its variance ($F=16,8$, $df=4,3$ $P=.001$) and by extra-professional e-use at its 12% ($F=51,8$, $df=9,2$, $P=.001$), showing an otherwise almost self-evident assertiveness due to the accredited qualifications obtained. Notably, it is this lack of satisfaction with one's endeavours that correlated highly and positively with the actual e-stresses experienced in the lab, reinforcing the idea that displeasure with one's efforts at work increases with the rise of e-duties.

TABLE XII

PEARSON PRODUCT MOMENT CORRELATIONS OF BURNOUT TO TIME ASPECTS AND TO ACTUAL E-STRESSES

CORRELATIONS OF BURNOUT TO TIME ASPECTS AND E-STRESSES						
	T(yrs) In This Job	T of study On One's Specialty	T of e- use out -of-job	T of (any) apt e-studies	T of e-use at this job	Actual e- stresses
EXHAUST ION	.147(*)	-.303(**)	-.253(**)	-.041	-.085	-.106
	.076	.000	.000	.569	.242	.081
DEPERSON ALIZATION	-.050	-.330(**)	-.313(**)	-.339(**)	-.335(**)	.017
	.415	.000	.000	.000	.000	.780
'NO-GAIN'	-.168(**)	.420(**)	.389(**)	.241(**)	.093	.239(**)
	.006	.000	.000	.001	.200	.000

Pearson product moment correlations for Burnout to all examined Time (T) aspects adjusted: Time in Service provision, Time in Studies on one's specialty, Time of extra-professional e-use, Time in (any) special/apt e-studies, Time of e-use in the current post.

**p < .01 // *p < .05

Once high hardies are in Control, they do not hesitate to overtly admit to e-errors while Commitment makes it difficult to submit faulty e-entries, especially when such e-functions are somehow conceived challenging, thus averting e-errors precisely because these e-functions are perceived to provide some sort of idiographic excitement. Apparently, as shown in Table XIII – A, external attributions are not evoked to excuse e-errors when high Hardiness is the case.

TABLE XIII – A
PEARSON PRODUCT MOMENT CORRELATIONS FOR THE MAIN E-ERROR
ASPECTS AS RELATED TO THE THREE HARDINESS DIMENSIONS

	E-ERROR ASPECTS CORRELATED TO THE THREE HARDINESS DIMENSIONS		
	CONTROL	COMMITMENT	CHALLENGE
E-ERRORS ADMITTED	,137(*)	-,121(*)	-,400(**)
	,025	,048	,000
ATTRIBUTION TO STRESSES	-,469(**)	-,345(**)	-,021
	,000	,000	,728

**p < .01 // *p < .05

On the contrary, all three Burnout dimensions directly and highly significantly point at nagging tendencies, forcing exhausted participants to attribute their e-errors to external causes. Further indication is offered by the highly positive association of admitted e-errors to the Depersonalization dimension, implying that e-errors can be seen as brought about by some 'known' carelessness, even some conscious indifference. Table XIII–B displays these issues:

TABLE XIII – B
PEARSON PRODUCT MOMENT CORRELATIONS FOR THE MAIN E-ERROR
ASPECTS AS RELATED TO THE THREE BURNOUT DIMENSIONS

	E-ERROR ASPECTS CORRELATED TO THE THREE BURNOUT DIMENSIONS		
	EMOTIONAL EXHAUSTION	DEPERSONAL IZATION	SENSE OF 'NO GAIN'
E-ERRORS ADMITTED	,086	,177(**)	-,025
	,158	,004	,687
ATTRIBUTION TO STRESSES	,626(**)	,223(**)	-,520(**)
	,000	,000	,000

**p < .01 // *p < .05

The higher, therefore, their Hardiness Control qualities, the more likely for participants to admit to certain e-errors, and, at the same time, the stronger their reluctance to overtly make external attributions by identifying responsible e-stressors other than the ones directly and conscientiously linked to themselves. Also, the Commitment quality signifies a drastic disempowerment of external e-attributions, and it too pertains to the prevention of e-errors. Because lower levels of Hardiness, i.e., Alienation proclivity, are closely related to the discrepancy between non-admitted e-errors and heightened e-stressfulness plus increasingly pointed attributions to external deficiencies and inadequacies of either others and/or the health care system, it may be that for medium and low hardies any admitting to e-errors may reflect an indirect inclination toward complaining about an added e-function, with regard to which these lab pros may feel somehow 'allowed' to err, as e-duties may overtax their otherwise multiple responsibilities – thus driving them here to exploit the chance to protest. May and colleagues had since 2001 stressed that for health pros the launch of the healthcare e-systems implies an unacknowledged investment in 'workability' [45] that has received minimal attention, though such e-function can deeply threaten the

entrenched professional beliefs around the nature and practice of these pros' traditional role.

Whilst strong negative relationships were formed between Hardiness total and the presently issued scale on e-attribution to external causes leading the respondents to e-errors, yet no association was observed between Challenge and attributional features in the sample – an equally meaningful absence, as long as by definition Challenge precludes any tendency to identify external loci of control and any depreciation of attractiveness in all endeavours willfully chosen by the individual.

The intensity of the participants' proclivity to complain about external factors supposedly forcing them to make e-errors was directly and highly significantly related to the experience of Emotional Exhaustion ($r=626$, $P=.001$). The Pearson product moment correlational analysis also indicated a highly significant positive correlation ($r=223$, $P=.001$) between this inclination to external e-attribution and scores on the Burnout Depersonalization subscale, while the same tendency of not assuming responsibility of one's inherent limitations, but rather, attributing them to external causes, was consistently highly correlated with the absence of any impression of satisfaction with one's attempts to make worthwhile accomplishments – the 'NoGain' measure ($r=-.520$, $P=.001$). That the same Burnout variable indicating sense of lack of success was seen to highly significantly correlate ($r=239$, $P=.001$) with the stress experienced by participants in their everyday professional activities particularly involving e-use (Table XII) must be interpreted in the context of these associations: *Under pressure (due to e-stress), some lab pros react by withdrawal from active involvement with, and composed engagement in faultless service provision (via depersonalization), while rationalization might offer some relief by blaming third parties (e-attribution), especially when there is no obvious acknowledged success and/or gain of them (Burnout "No-Gain" dimension).*

The overall minimal scores obtained from the direct measure of e-errors were considered mathematically liable for the marginal correlational strength of this scale to the rest of the variables. However, good indication of the suspected denial aspect of this result was provided already from the correlation matrix: Despite the poor scoring in overtly admitting e-error making, the highly significant ($r=177$, $P=.004$) relation of the subtle Burnout symptom of Depersonalization to such e-error confessions hinted upon denial. Moreover, the strong total Hardiness quality as highly negatively related to the same e-errors-admitted variable ($r=-.174$, $P=.004$) tackled the causative inquiries that should be accordingly made. With these liabilities pending, regression approach was triggered. Tables XIV–A and XIV–B illustrate main explanatory linkages among the crucial variables of the study. In fact, although unclear at the univariate level of causation, still, at the multivariate one (cf. Table XIV–A) Depersonalization managed to be seen to explain 11% of the actual 'e-errors admitted' variance ($r^2=.111$; $F=11.06$, $df=6,1$ $P=.001$). Similar effects were observed for Emotional Exhaustion and 'NoGain' at the univariate level, with the

multivariate account revealing some additional explanatory, albeit weaker, weight of 3% of the variance of the actual 'e-errors admitted' variable for each.

TABLE XIV – A
REGRESSION ANALYSES' RESULTS OF BURNOUT AND HARDINESS
ON E-ERRORS-ADMITTED BY THE HELLENIC HOSPITAL STAFF

Selective Standard Regression Analyses on the Hellenic Hospital Lab Staff "e-behaviours"			
e-errors admitted			
	β	t	r^2 :% (st-err)
Exhaustion	.034	4.37	.007% (0.2)
Depersonalization	.078	2.93*	.031%* (0.2)
"No-Gain"	-.014	-0.40	0%
Control	.378	7.77**	28%** (0.2)
Commitment	-.400	-7.14**	17%** (0.06)
Challenge	-.434	-8.06**	25%** (0.3)
Total Hardiness	-.253	-9.50**	25%** (0.3)

**p<.001 // *p<.01

Selective display of main regression analyses results of both Burnout and Hardiness as for their main effects on e-error 'confessions'.

Subsequent inspection of high Hardiness confirmed that it tends to explain e-errors admitted by 25% of the variance ($F=51$, $df=3$, $P=.00$), mainly due to high Control ($r^2=.28$; $F=8.2$, $df=1$, $P=.00$) and high Challenge ($r^2=.25$; $F=23.1$, $df=2$, $P=.00$) and less due to high Commitment ($r^2=.17$; $F=51$, $df=1$, $P=.00$).

TABLE XIV – B
REGRESSION ANALYSES OF BURNOUT AND ALIENATION ON
E-EXTERNAL ATTRIBUTIONS BY THE HELLENIC HOSPITAL STAFF

Selective Standard Regression Analyses on the Hellenic Hospital Lab Staff "e-behaviours"			
e-(external) attributions			
	β	t	r^2 :% (st-err)
Exhaustion	.376	13.15**	39%** (0.3)
Depersonalization	.148	3.75**	5%** (0.2)
"No-Gain"	-.492	-9.95*	27%** (0.4)
(-) Control	<i>S</i> -.821	<i>-8.68**</i>	<i>22%** (0.9)</i>
(-) Commitment	<i>P</i> -.385	<i>-6.01**</i>	<i>11%** (0.6)</i>
(-) Challenge	<i>L</i> -.035	<i>-.348</i>	<i>0%</i>
Total Alienation [(-) Hardiness]	<i>I</i> -.706	<i>-8.50**</i>	<i>21%** (0.1)</i>

**p<.001 // *p<.01

Selective presentation of main results of standard regression analyses of both Burnout and Hardiness as for their main effects on e-error (external) attributions. The section in italicized characters denotes results from elaboration on Hardiness semi-splits for exclusively Alienation scores.

Nevertheless, it is distinctively Alienation emerging via semi-splits that tends to explain some 21% of the external 'e-attributions' variance ($F=72.3$, $df=1$, $P=.00$) exclusively via [lack of] Control ($r^2=.22$; $F=75.3$, $df=1$, $P=.00$) and [lack of] Commitment ($r^2=.11$; $F=36.2$, $df=1$, $P=.00$) while Challenge appeared, as it should, incompatible to external e-attributions. On the other hand, while the three Burnout dimensions failed to explain the 'e-errors admitted' variance, yet, all three managed to contribute to explaining 39% of the external e-attributions aspect, chiefly via Emotional Exhaustion ($r^2=.39$;

$F=173$, $df=1$, $P=.00$) and the sense of 'No Gain' ($r^2=.27$; $F=99.1$, $df=1$, $P=.00$) than Depersonalization ($r^2=.5$; $F=14.1$, $df=1$, $P=.00$). A set of these relationships is shown in Table XIV – B.

In sum, the generally low ability of Burnout to explain e-error making per se as contrasted by its high ability to explain e-attributions, along with the exactly reverse findings with respect to the Hardiness-versus-Alienation personality compound substantiated that audacity to report e-error making does seem to 'belong' to Hardiness, whereas committing e-errors, which, however, are only indirectly identifiable through excessive complaining about third parties' faults, appears jointly ascribable not as much to Alienation as to Burnout.

V. DISCUSSION

Findings, limitations, implications

Conceptually, Hardiness pertains to the cognitively driven embodiment of serenity, forthrightness and wit toward self- and significant others'- growth in the face of even the most trying circumstances, en route for quality living, whereas its opposite, Alienation threatens with disorganization and aimless meager survival.

Burnout represents a sequential situational state of worsening stress-towards-anxiety reactions that affect somatic and mental functions to the extent of physical disturbances, impatience, irritability, fatigue, job absenteeism, achievement underrating, performance deficits, indifference, detachment, cynicism and mental dysfunction. These are all ailments that could also apply to Alienation traits, though not quite – since the latter purports to core personality characteristics that produce such disquieting infirmities, whereas the former constitutes a rather circumstantial consequence: Burnout tends to depend on incidental and specifically vocational stimuli out of which symptoms are supposed to evolve.

Based on these tenets, and on the research results presented, it appears quite safe to put forward the initial stipulation that Hardiness rather than Burnout would provide sufficient correlational and explanatory clarification on e-error occurrences and e-error external vs internal attributions regarding such occurrences. To the best of its knowledge, this study may claim originality in this respect not only among studies on the Hellenic hospital lab reality, but also among international queries as to both the Hardy personality construct in laboratory expert staff and the lab erroneous computer entries theme. Although studies have shown the importance of the interplay among Hardiness and Burnout in the past cf.[46], it was here felt that little attention has been given to the Alienation aspect of the former and too much concentration has been exhibited on the situational sequelae of the latter – albeit some [47] have productively pointed to the direction of differentiating between the two, by depicting Hardiness as the predominant influential factor that outweighs other variables in explaining Burnout.

In a recent prospective longitudinal study, one that bares the greater proximity to the concepts, orientations and queries posed by the current one, Gopal and colleagues examined

Burnout and Hardiness in internal medicine residents regarding long-hour on-call reductions [48]. Although its scope was far from investigating e-errors and e-attributions, however, these researchers' findings and review supported that long-hours on-call led to delays in test ordering, augmented complications in patients, increased medical errors, intense attention deficits and, generally, high risks entailing deteriorated quality of care – thus coinciding with the present shared concerns regarding the devastating consequences of e-errors committed. Unfortunately, resident hardiness in that study was only accounted for in terms of whether residents would exhibit any differences between the years under inspection, and since no such finding emerged, personality factors were deduced not to influence burnout rates. It is here advocated that findings in that study may well reflect at least two latent features, one procedural, and one conceptual: That is, on the one hand studying Hardiness via the thirty-item Cognitive Hardiness Scale by T-scores of fifty with large standard deviations of ten might cast shadows on such an amalgamated personality construct. On the other hand, changes in the personality construct are distinctly hard to develop unless intervention is formulated and looking for trait differences within and between groups while monitoring shift duration changes (a downright circumstantial variable) might decrease the clarity of these very traits to entirely unfold.

The current findings confirmed the a priori hypothesis probably owing to a) the use of prepilot tested measures, b) the modified fifty-item hardiness-vs-alienation scale proven of its small standard deviations of well below three and c) the insistence of repeated clusterings plus the repetitive regression analyses corroborated by squared semi-partial correlations which made the distinction of the Hardiness-vs-Alienation influence feasible and clearer – all due to the conceived sensitivity of the cultural determinants in the specific sample chosen and the bureaucratic concomitants in the topic under scrutiny.

Limitations of this study must be noted. One way to look at the theme of e-errors is to record them, but this approach alone would leave out subjectivity – a major factor of cognitive perception especially in the actual doers; another way to investigate e-errors is to monitor subjective estimations of a sample, aiming at mostly indirect reasoning on their occurrence, but this would again be threatened by plausible biases such as the social desirability factor or the transformation of certain scales into complaint charts. It was here attempted to explore the issue both ways so as to reduce effect of both shortcomings. Still, the adopted approach remained random in a number of ways which were at any rate dictated by the very nature of the pertinent pilot interest: i) staff members of rural hospitals who were on call on the very day and hour of the planned visits of each institution were randomly approached, thus missing participation of potential respondents of other shifts became an inbuilt potential weakness; ii) random selection of the target-institutions might be argued to undermine expansion of generalizability; and iii) arbitrarily ending up with the specific prepilot sample retrieval at a N=140, controlled for sex rather than specialty, as it

should have probably been the best, might be taken as an avoidable limitation. However, given the high response rates secured, and the representativeness of the pilot sample's formation regarding the Hellenic hospital lab staffing reality, as well as the evidence on sex non significance in the obtained results, along with the Hellenic samples' known reluctance to respond to research participation calls, some confidence was gained on the emerging findings' credibility, hence fairly overcoming all three of these perils of randomization. Besides, in a way, this approach may well be perceived as desired, inasmuch as the aim was precisely to take a "snapshot" of e-errors at random spots, in random timings. In addition, results essentially confirmed the predicted fear of the respondents' partiality in answers related to e-errors, since one of the most important and expected finding was the stipulated 'denial factor' as denoted by the contradiction between the actually reported (few) e-errors versus the 'blaming' tendency on factors leading to them, precisely in the absence of overt e-error disclosure. Moreover, whilst in other cases transforming a questionnaire into a complaint chart might absolutely discredit findings, in this case it was strongly felt that such an aspect was one of the study's verifying features, as the termed 'denial factor' defense of 83% of the staff 'blaming' third parties for, versus just 50% reporting actual e-errors, did tend to confirm the uttered fear of e-duties overburdening lab staff, and was added in the interpretation repertoire of reasoning as a useful argument. Further, by the same tendency of respondents to indirectly complain about their excessive e-duties, it appeared that the social desirability factor was destabilized at a very satisfactory level.

As in any correlational study, results were not systematically presented in terms of causative attributions. However, as performing various regression tests proceeded, it became feasible to produce adequate indications on the importance of the findings at this causative level, too. In fact, as analyses also came across absence of heteroscedasticity in the examined relationships of the variables under inspection satisfactory assurance in the relevant interpretation attempts was given – which was further empowered by colinearity verification of residuals in all key-relationships under inspection.

A critique might also refer to the fact that this study refrained from exploiting the prepilot findings on selective costs of e-errors by statistically elaborating them in conjunction with the rest of the data made available. However, as mentioned, the pilot nature of this work led just to selective cost monitoring with an aim to justify the investigative direction chosen. Thus these tallies were deemed insufficient for further exploitation in the current circumstances; future efforts should certainly be planned to expand on this issue, too.

All in all, the present approach attempted to blind respondents to the research expectations and to the philosophy underlying most of the measures issued – for example, exploiting the conceptually indistinct phrasing of the Hardiness questionnaire, made it possible to entitle it as: 'opinions/views' – although such a precaution could not be

feasible in all cases, as, for instance, in the case of Burnout as its phrasing is inescapable of denoting its aim of exploring aspects on fatigue due to workload. However, overall meaningfulness of outcomes helped maintain some certainty on distortions avoidance, though of course future research is necessary regarding expansions on especially numbers of participants and different posts held in the hospital hierarchy and specialties: Surely, in this specific sample, the nurses' profile was radically different from the profile of their counterparts in other hospital departments, as most previous Burnout studies find nurses highly exhausted/burnt out while this one did not. Although this seemed to make perfect sense for the specificities of the current work, the question as to the potential influence of hardy qualities that could differentiate among subgroups of nurses in other health care settings remains open until such inspection is launched.

Strengths of this study must also be noted. As stated, inspection of e-errors in relation to both core personality Hardiness and proclivity to Burnout has not been previously attempted. In addition, the study claims to contribute to uncover the very issue of e-errors plus external loci of control in their attributions, by indirectly showing their being a major source of added risks for patient safety, satisfaction, and value for expenditure, and by directly screening their potential origins in personality rather than mere occupational fatigue. The analyses employed were set to highlight results at no less than the 99% confidence interval, so as to weight only highly meaningful findings, thus balancing for any inadequacies of the sample size. It may be supported that findings shed new light to a restricted number of relevant empirical information and opened a new personality-oriented pathway to solutions for what appears to be a growing problem of e-errors and e-attributions, inasmuch as mounting e-functions are increasingly required by an already overtaxed staff.

Faulty computer entries in the lab do not seem to crop up directly through Burnout symptoms, but it appears that Alienation may additionally explain their occurrence, thus indicating a need to look into personality characteristics before intervening with launching corrective tactics. On the other hand, high Hardiness may actually be the personality asset to know, not only if, but also by whom such e-errors emerge – indeed, by the liable high hardy persons themselves. The latter do not seem to belong to the breed of the 'blamers', but are essentially self-conscious to accept responsibility of their actions: As hypothesized, Hardiness explained much of the variance for the core 'e-errors admitted' dimension of interest here, as well as the 'e-attributions to the self' aspect of the e-errors attributions measurement in quite meaningful ways. As seen in the correlation matrices, those who are especially in Control do take the responsibility and actually report making e-mistakes, whereas their qualities of especially Commitment and, in an indirect way, Challenge, tend to effectively buffer their doing so to a great extent. Hence, Hardiness-total along with its 3C's tends to explain much of the variance for sincerely admitting to e-mistakes, and at the same time promises success in any future interventions that will be based on Hardiness tenets to minimize annoying e-errors.

Although stressors related to the lab e-functions, just like in the e-error scale, were distinctly underreported by the majority of the respondents, yet the Hardiness construct did tend to encompass this undesirable event as well, in an equally meaningful way: Control surfaced as the leading quality that welcomes rather than rejects e-stressful occurrences and as the key factor for sincere acceptance of one's e-mistakes thus prompting individuals who may develop this quality at heightened degrees to thrive rather than deteriorate in the face of realistic difficulties of e-burdens and e-duties.

Unfortunately, this sample's profile still appeared as generally imbalanced in terms of Hardiness ingredients and, for this reason, at worrying and serious Burnout levels. This suggests a shift from the statistical relationships identified in earlier studies, and could be attributed to a number of added factors: changes in social pressures; changes in organizational pressures; and/or changes across time in the individual profile of at least health carers (sic). Reluctant to solely comply to any, or at all, the present study would reason that these findings indicate an increase in relative importance of certain wished-for privileges, such as: the time and money availability to continue one's studies, or the more overtly expressed need for kin-and-peer acknowledgement and support of one's performance ('e-attributions'), rather than a decrease of interest and involvement in the personal and professional choice of status *per se*. It would also be worthwhile to comment that findings here plainly ascribe these weaknesses to Alienation. Recent findings from Taylor and colleagues in 2005 appear to support this interpretation when referring to the augmentation of stressors in the health profession as major causative factor for emotional exhaustion rather than to some personality trait alteration/distortion [49]. It is here felt that this sample's general e-behaviour as portrayed here reveals a perhaps contemporary readiness to protest against situations that might have been equally burdensome in the past, but expressed more openly by persons in the present. In either account, mental distress is here understood not to be caused by any concrete current occupational conditions, but to precede them pertaining to personality disposition. Tyssen with colleagues had already since 2001 shown that proclivity to strain (here e-strain) may have firstly occurred during the study years [50], and the current work is inclined to assume even earlier in life.

That younger staff appeared at higher risk for personality imbalances, burnout proclivity and a stance of external locus of control, even e-indifference, looked as if lessened by indications of self-confidence due to their more extended and thorough specialty-, and e-study- Time. It would therefore seem appropriate to suggest that future Hellenic hospital lab personnel should either be drawn from a pool of long-educated, and early starters in e-use (which, as mentioned, is not currently the case with Greek senior staff), or be offered more study Time at convenient intervals throughout their professional life, perhaps directly towards the scope of improving their e-skills, but certainly needful of additionally enabling them to prevent burnout risk and, most importantly, empowering them to develop their hardy qualities.

Maximization of the latter might not be readily feasible unless hospital policies consider staff support, perhaps precisely making the first step by endorsing tactics towards the minimization of e-errors via time and psychological aid allowances for their lab personnel.

But as Maslach and Leiter eloquently put it, as early as in 1997, 'globalization highlights the weak points in the economic systems of industrialized nations by increasing competitive pressures...' without which, however, problems would not have been readily addressed. Yet, '...in pushing for efficiency, competitive pressures make corporations myopic...' since (...) 'They cut costs in the short term at the expense of programs and policies that would make sense in the long run' [51]. Nevertheless, the rapid entry of information technologies in the contemporary hospitals does not necessarily guarantee either qualitative or quantitative, patient, or staff satisfaction [10]. Personality, however, has not widely concerned reform policy makers, although repeatedly proven to unveil the methods and the tactics for enhancement of service provision at even the micro-functions of everyday e-health care provisions – which, nonetheless, are too dearly costly to overlook.

Weingart and colleagues were bold in their review [52] of research on medical error when stressed the common grounds shared by most studies: Cognitive errors both prevalent and preventable in the health care system are more threatening than mere technical errors. The present work submits that even such technical errors, predominantly e-errors that appear to raise such grave economic problems verified in the literature [53] and surfaced in the present empirical accounts, are surely subject to adjacent cognitive functions, which, in turn, may be drastically controlled through the empowerment of hardy qualities within individuals in the realm of personality intervention tactics.

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