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Healthcare performance data turned into decision support

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Abstract
This paper has focused on identifying the determinants having direct impact on levels of employee absence in a healthcare organization seen from a practical viewpoint. Exploiting the acquired knowledge, a management framework is proposed giving hospital managers an overview of the determinant's respective levels. The data foundation consists of employee satisfaction surveys exclusively, stemming from two Danish public hospitals. The framework comprises of four major clustered factors being 1) *general satisfaction*, 2) *fairness*, 3) *reliance*, and 4) *cooperation;* the last three covered by the term social capital. Use of the framework enables potentially greater impact of future initiatives.

Keywords: Key Performance Indicators, sickness absence, performance measurement

Introduction
An increasing internal complexity in healthcare has caused difficulties in steering organizational performance through troubled waters. Also, external complexity is higher than ever, especially since patients in general have become well aware of their personal rights. A global economic recession beginning in 2008 adds to the complications, resulting in several rounds of layoffs and lowered budget limits in the healthcare sector. All these challenges haunt the managers at the hospitals. Many different initiatives concerning changed working procedures and improved technologic solutions are initiated to meet the increased requirements.

Timely, reliable information is judged an important requirement to maintain correct treatment of patients, meanwhile promoting a healthy working environment.
Since the current employees must run faster to deal with more and more patients, their presence at work functions as essential cog wheels in the healthcare management clockwork. One way of utilising the current workforce to an optimum is to focus on attaining a theoretical minimum of sickness absence rates. In continuation, most literature uses the term *sickness absence;* a term which is judged too imprecise by the authors. Sickness absence is not intuitively associated with absence due to motivational reasons. Therefore, the term *employee absence* is introduced instead, covering absence types caused by lack of motivation as well as being physically hindered in attending at work. This issue has been addressed by numerous social scientists trying to conceptualise this complex phenomenon for decades (Dekkers-Sánchez et al. 2011). The scope for these attempts has primarily been to grasp motivational- and economical causes to absence (Løkke Nielsen 2008; Kristensen et al. 2006; Barmby et al. 2004).
Both researchers and healthcare managers have not been able to agree on a common model, which generically can assess determinants in employee absence. Numerous factors influence absence rates meanwhile differing in impact as well, making the development of a generic solution a difficult task at hand. Interviewing healthcare professionals revealed a shared agreement that missing employees would leave departmental performance to suffer. Lower quality in patient nursing, waiting times on the increase, and cancellation of planned surgery would be some of the consequences of less available staff. On the contrary, evidence proving otherwise was found at a Danish public hospital. Here, shorter waiting times, higher patient satisfaction, and lower mortality rates were observed in the short run (Drachmann 2011). What can readily be concluded is that determining what controls employee absence rates is a highly complex and difficult task.
This paper strives to present new knowledge of how to find which factors can be seen as determinants of absence rates in a health care department, while suggesting a practical solution to monitor the development of these determinants.

Methodology

The preliminary research comprised of mapping several factors directly to employee absence based on peer-reviewed articles primarily found in PubMed and Web of Science. Formal- and semi-formal interviews were conducted concurrently with hospital staff at all levels to shed light on possible elements not mentioned in the literature. Common to most of the articles included is that they investigate single or few factors in terms of controlling employee absence levels. It was possible to sketch an overview chart somewhat analogue to an $IDEF_0$ diagram; a technique normally used for modelling manufacturing processes. The overview chart had the benefit of granting better comprehension of which factors have been suspected to influence employee absence the most. The factors are categorized into either voluntary- or involuntary absence reasons (Chadwick-Jones et al. 1982).
If determinants in employee absence are to be identified in a specific department, we need to turn away from literature findings and actually test these findings on empirical material. Two calculation methods have been applied for this purpose; Pearson correlation analysis and calculation of social capital.

Pearson correlations were calculated using employee satisfaction survey scores and corresponding absence rates from two healthcare departments from different Danish public hospitals. The two departments were paediatrics and radiology accordingly.
The equation used for calculating the Pearson correlation coefficient is as follows:

$$\rho = \frac{1}{n-1} \sum_{i=0}^{n} \left(\frac{x_i - \overline{x}}{s_x} \right) \left(\frac{y_i - \overline{y}}{s_y} \right) \quad (1)$$

, where n equals the total number of data sets correlated, x_i and y_i the specific values of the observations made in each data set, $\overline{x}$ and $\overline{y}$ are average observational value and finally s is indicating the standard deviation (Miller et al. 2005).
Now another approach is undertaken. Social capital has been in focus for a decade to assess level of employee contentment and can with reason be hypothesized to influence absence rates (Olesen et al. 2008). Therefore, the social capital was calculated using accumulated scores derived from four specific questions found in the employee satisfaction surveys. The term social capital contains the elements *fairness, reliance,* and *cooperation.* An example of quantifying social capital is given below.
A question containing five different answering options is distributed as follows: very good = 12 %, good = 28 %, mediocre = 37 %, poor = 20 %, and very poor = 3 %.The different percentages are multiplied by a factor from 4 to zero:

$$(0{,}12 * 4) + (0{,}28 * 3) + (0{,}37 * 2) + (0{,}2 * 1) + (0{,}03 * 0) = 2{,}3\ points \quad (2)$$

The scores derived from the four questions used to quantify *reliance, fairness,* and *cooperation* is accumulated to one number constituting the social capital. The formulated questions can be seen in Table 3.

Linkages investigated in included literature
Most of sickness absence literature is based on observational studies differing in sample sizes and settings. Commonly, qualitative research methods serve as a mean to verify or reject hypotheses about determinants in employee absence (Schreuder et al. 2011). As a conclusion, the stated hypotheses usually give rise to more hypotheses left to be investigated. Hence, interventional research is in high demand. This paper suggests a practical solution which can readily be tested in practice.
Indeed, many factors have been said to have influence on employee absence rates. These factors differ greatly in an array of aspects and have proven difficult to objectively sort into clearly defined frames. The authors were inspired by Driver and Watson's framework proposed in 1989 suggesting to separate voluntary- and involuntary absence (Driver and Watson 1989). It is acknowledged that the positioning of some factors can rightfully be placed on either side of this line, meaning a certain degree of subjectivity cannot be ruled out. Personal traits differ greatly thus reducing generalizability potential. For instance it is highly individual when a "sufficient" amount of sickness has set in preventing attendance at work. Validation of the placement of factors has been sought through interviews with hospital staff employed at two different Danish public hospitals.

Notice that only factors leading directly to employee absence have been depicted in Figure 1. Presenting interrelated linkages alongside the directly influencing factors would better the comprehension of the employee absence mystery. However, it has by the authors been deemed not beneficial in the attempt to construct a practical management framework, since the overview chart would become increasingly chaotic.

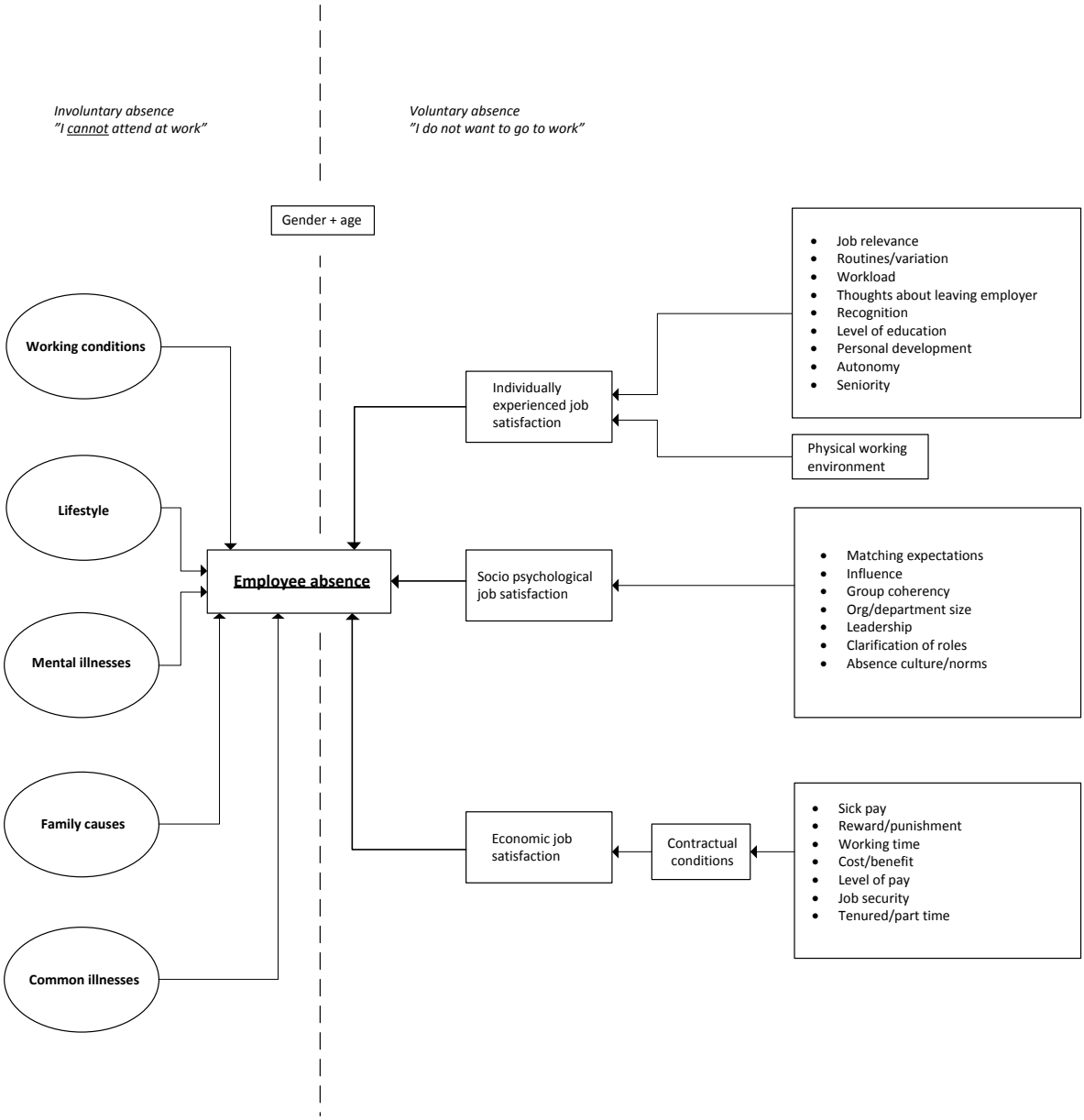

Figure 1: Overview of factors with direct influence on employee absence level

One factor having been addressed in much literature is gender and age related to levels of absence. Undoubtedly, more personal characteristics can be assumed to inflict on absence levels, yet none of these are addressed in the included literature.

A reason might be that these issues remain hidden and are tricky to gain an understanding of. None of the elements presented in Figure 1 are stated to be governing causes but only contributing to the level of employee absence.

Finding determinants in employee absence

A gross portfolio of factors based on attention in absence literature left to be further examined is available at this point. These factors are to be tested on the empirical data material. The order in which the factors are tested depends on the amount of focus given in the included literature. Quantification of the factors is a necessity in order to apply Pearson correlations. Some of the factors are easy and apparent to quantify and some are not. One way to rapidly quantify the more "soft" values is by the use of employee satisfaction survey scores. Each factor is carefully associated with questions posed in the employee satisfaction surveys. In turn, the factors are compared to the development in absence rates for the converging years. Highly negative- or positive correlation coefficients points towards possible coherence between a given factor and absence rate. Employee satisfaction survey results with appended absence rate statements for the same three years of conducted satisfaction surveys have been provided by the two previously mentioned Danish public hospital departments. Since measuring the level of staff contentment is no obligation by law, the conduction of surveys is rather sporadic. The sample sizes and response rates are presented in Table 1:

Table 1: Sample sizes and response rates for included employee satisfaction surveys

	Hospital 1			Hospital 2		
Year of conducted survey	2006	2008	2010	2007	2009	2010
Sample size	160	180	150	98	125	72
Response rate	64.0 %	77.8 %	93.8 %	71.2 %	74.0 %	58.0 %

In the result overview chart (Table 2), the correlation coefficients ρ are presented along with clustered categories and drivers. To support the evidence of the highly correlated findings, similar results were sought in the literature. Highly correlated factors have been defined as $\rho > 0.75$ and $\rho > -0.75$. If a driver is mentioned twice but with numbering, the reason is that different questions are used for the driver. Also shown in Table 2 are highly yet contradicting correlation coefficients (see for example *autonomy*). There can be many different reasons to contradicting correlations. These findings could possibly be explained by investigating further the cause and effect at specific dates. Statistical strengthening of the results obtained may be found when more employee satisfaction survey scores are carried out and gathered. One exception has been made to the driver *job security*, which was included in accordance with causality in literature findings.

A result worthy of elaboration is a positive correlation coefficient in *general satisfaction with working condition*. This result suggests that the more content you are, the higher absence rates are evident. High degrees of freedom and low amounts of responsibility are guessed to explain the underlying cause for the result.

Table 2: Presentation of comparable results between the two included hospital departments

Category	Driver	ρ Hosp. 1	ρ Hosp. 2	Causality
Mental illness	No bullying		0,973	
	Fairness		-0,821	x
Working conditions	Gen. satisfaction with work. cond.	0,997		x
Economic job satisfaction	Job security	0,715		x
Socio psychological job satisfaction	Cross-functional teamwork 1)	-0,990		
	Cross-functional teamwork 2)	0,925		
	Clarification of team roles	0,550	0,779	
	Management style	0,392		
Individual job satisfaction	Job relevance	0,768	0,982	
	Workload 1)	0,991	0,866	
	Development of personal skills	0,984	0,615	
	Thoughts of leaving current employ.	-0,774	-0,696	x
	Autonomy	0,946	-0,978	
	Workload 2)	0,824	0.122	
	Routines/variation	-0,567	0,035	
	General satisfaction 1)	0,035	0,569	
	General satisfaction 2)	0,127	-0,887	

Further investigation of the social capital was conducted afterwards. Employee satisfaction data from four Danish public hospitals were applicable for this purpose; three of them being from separate departments, i.e. radiology, paediatric, and anaesthetics, while a single reflected the entire hospitals estimate. The results are presented in Table 3.

Table 3: Social capital questions, results, and final score

		Reliance	*Reliance*	*Fairness*	*Fairness*		
Hosp.	Dep.	The managers bear trust in employees? [points]	Confidence in management's announcements? [points]	Are tasks distributed in a just manner? [points]	Are conflicts solved fairly? [points]	Total soc. cap. score [points]	Absence rate (mean) [%]
1	Rad.	3.0	2.8	2.8	2.5	11.1	3.9 %
2	Paed.	2.8	2.4	2.2	2.4	9.8	4,3 %
3	Anae.	2.5	2.2	2.1	1.8	8.6	5.2 %
4	All	2.7	2.6	2.4	2.4	10.1	4.9 %

The results show a tendency that the level of social capital is linked to levels of absence. An alert reader may spot that the element *cooperation* is not included in the above table. To measure the level of cooperation is less straightforward because the organizations' structure, size and culture may differ. These variations cannot be captured by a generic standardised questionnaire. However, the four questions in Table 3 are sufficient to present an accurate picture of the social capital.

Putting the determinants into a practical setting

Knowledge about which determinants are of governing cause to employee absence in the department allows for precise and effective action. In theory, a continuous monitoring of these particular indicators will pinpoint where to focus interventional acts to lower employee absence rates to a theoretical minimum. This can be achieved by the use of the developed management framework shown in Figure 2. Selected questions linked to the determinants can be merged into future employee satisfaction surveys to check the status of the determinants. The more registrations on the determinants are made, the better the knowledge of the determinants common influence. Beginning from the left hand side in Figure 2, the superior categories are given. Next, the significant clustered factors are stated. The "note" column show which questions are used explicitly to quantify the clustered factors. The scores range from one to five. It is important to be careful when formulating the questions because the scores have to correspond. In order to present the scores in an intuitive and easily comprehensible manner, underlying macros transform the average scores (seen in the outer right column) into a hachured code being dark, grey or light. Dark areas are the most alerting areas of interest. Light dotted areas (such as for instance reliance) need close monitoring to see whether the development turns into better or worse. Striped areas are, at the time of assessment, well-functioning areas in no need for immediate attention. If however a given score takes on a value near the threshold value between two intervals, the definitions does not take this into account. A high average score will be interpreted as being satisfactory, thus attaining stripes (fairness as an example of such). The questions must therefore be formulated positively. The two columns on the outer right hand side show first the numerical score stated for the given question(s) and second the total average for the clustered factor. The management framework can easily be adjusted if more/other indicators need monitoring.

Discussion

As a healthcare manager, employee absence can be regarded as being an important yet single element in a complex interwoven web of interacting performance indicators. This paper has sought to fill a gap between the current handling of healthcare data registrations and utilising this information for the benefit of enhanced performance management, exemplified through employee absence.

To measure performance today, an increasing number of IT-solutions are continuously developed to deal with the vast amount of available data. The programs have in common that they can handle the data in acceptable time and are able to communicate between platforms. As user, you are on your own in finding whatever information desired. Hence, the structuring of data so that only useful information is highlighted is of particular interest. Implementation of digital dashboards, such as the one suggested in this paper, to aid presentation of organizational performance intuitively is not new to healthcare institutions (Morgan et al. 2008). More focus to the benefits of quantitative process management in industry seems to have inspired healthcare organizations in their quest to become lean. The wish for information is of course varying from person to person making information management a difficult task to handle. An opportunity to satisfy both low- and high level requirements in information is most wanted.

12.04.2012		Projectname:		Clear scores							
		Made by:			Low degree	- Some extent -			High degree		
Category	**Factor**	**Corresponding colour**	**Note**		**1**	**2**	**3**	**4**	**5**	**Score**	**Average**
Element 1, social capital	Fairness		Are conflicts solved in a just manner?						x	5	
			Are you acknowledged for a job well done?						x	5	
			Do the management always treat suggestions seriously?						x	5	
			Do work tasks get fairly distributed between employees?					x		4	4,8
Element 2, social capital	Reliance		As employee, are you able to express your opinion?				x			3	
			Do you have confidence in the way the top management manages the work place?				x			3	
			Can you trust the announcements made by the management?			x				2	
			Do the managers bear confidence in their employees?				x			3	2,8
Element 3, social capital	Cooperation		Is there a great working relationship between your colleagues?						x	5	
			Do you experience a good cross sectional teamwork?					x		4	
			Do you have a good professional relationship in your department?						x	5	
			Do you get aid and support from your colleagues when needed?				x			3	4,3
General satisfaction	Job security		Do you feel safe regarding your work-related future at the current employer?		x					1	
			Do you feel secure in your current employment?			x				2	1,5
	Working conditions		Are you content in terms of ergonomics? (lifting, working postures etc.)?			x				2	
			Are you content with the ergonomic tools used to lift heavy loads?			x				2	
			Are you content regarding the safety procedures (i.e. handling of needles, chemicals etc.)?					x		4	
			Are you satisfied with your working conditions in general?				x			3	2,8
	New job?		Do you plan on staying in your present job?		x					1	1,0

Figure 2: Checklist sheet, exemplified

Multiple attempts to create such a solution, which in a holistic manner shows not only the actual figures but also the relations between indicators directly influencing performance, have been carried out in vain (Neely et al. 2005). In 2011 however, Traberg suggests a concrete method named a Performance Account which presents performance data in a clear and holistic fashion (Traberg 2011). This Performance Account is sketched as a tree involving three branches of indicators categorized as patient, employee and operations. The Performance Account has the advantage of presenting indicators in different levels of detail, thus giving the user the ability to check the indicators' values. However, what the Performance Account lack is the relation between the indicators. Applying the same mind set as presented in this paper, in depth knowledge about where to focus initiatives and what the proposed effect can be expected would be achieved.
Opening up the individual issues and investigating the relations further will be a decisive step towards efficient performance management. No doubt, it will be a difficult and comprehensive task involving a thorough analysis of which indicators are most relevant for departmental performance and how to quantify and define the more "soft" values connected to quality. Possibly, using mixed research methods will identify the most important indicators while afterwards investigate their intermediate relations by the use of statistical methods such as cluster analysis or multivariate statistics. Testing the results in practice iteratively seems evident to constantly optimize the usability of a performance management framework.

Conclusion

Applying a purely quantic approach will no doubt be only a part of the truth in understanding employee absence. Many hidden issues may be relevant and controlling absence behaviour and cannot be acknowledged in a generic model. This is why triangulation of methods, involving also qualitative research methods such as interviews with relevant staff, may leapfrog to better understanding of where to direct attention. Higher impact on future initiatives will then be reached. The method applied in this paper is deemed applicable in a broader sense to identify other determinants in different elements relevant in measuring performance. This goes for healthcare as for any other sector. To understand the coherence between the factors while afterwards making use of interventions to optimize accuracy in performance measurement is of great importance. Health care managers are in dire need in understanding what factors have the most impact on employee wellbeing. The suggested model may serve as a preliminary step in gaining a deeper knowledge of what works, though it is acknowledged that more exhaustive research in the area is needed.

Limitations

Since the model has not yet been tested in practice and data are provided from only few healthcare organizations, generalizing potential is low. Inclusion of more data stemming from a global selection of equal public hospitals having a similar healthcare system compared to the one in Denmark will provide statistical evidence for the statements raised in this paper. The methodology used may serve as inspiration for future research in the field of interventional performance management and is not only restricted to the healthcare sector.

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