

Identification Factors of Poor Quality of Data in the DOTS Program

Bahtera B. D. Purba, Anggi Pramono Siregar, Cristica I. Surbakti, Bunga Rimta Barus

Faculty of Public Health and Faculty Of Pharmacy, Insitut Kesehatan DELI HUSADA

[Bahterabd, bungarimtabarus, christica, anggipramono95]@delihusada.ac.id

Keyword: Tuberculosis, Quality of Data, DOTS Program, Information Systems

Abstract: At Deli serdang, Indonesia, in 2016, 52% of the DOTS data quality was in the bad category and did not show changes since 2013. This study aims to determine the factor of poor quality of data in the DOTS program. Participants in this study were DOTS officers from 34 Puskesmas in Deli Serdang and 16 Puskesmas in Serdang Badagai to 50 respondents. The study was conducted by descriptive analytic method with Cross Sectional approach. The research instrument has been tested for validity and reliability at a confidence level $\alpha = 0.05$. Data were analyzed using logistic regression at a confidence level $\alpha = 0.05$. The results of the research showed that there was a affect of the behavioral ($p = 0,000$; $p < 0.05$), organizational ($p = 0.018$; $p < 0.05$), and technical determinant ($P = 0.006$; $P > 0, 05$) with DOTS data quality in Deli Serdang. It is suggested to head of the Puskesmas to conduct data management training to DOTS staff of the health center regularly (minimum 1 time a year).

1 INTRODUCTION

In Deli Serdang Regency, Indonesia, in 2016 52% of DOTS data (directly observed treatment Short course) programs were classified as poor (Purba, 2018). Poor quality of data is accompanied by an increase in TB cases (tuberculosis) from 1156 cases in 2015 to 1336 in 2016 (Purba, 2018). This increase has an impact on TB cases of treatment failure and MDR-TB cases (Akil, 2017).

Data quality is essential in the TB surveillance system. In many cases, the quality of health data and information is only considered as a responsibility in the organizational structure. This situation leads to the assumption of organizations and individuals that the data is not useful and biased. Data is only considered as a document that contains the achievement of programs that are written quite well (Hartati, 2016).

The data quality methodology builds on existing data quality assurance mechanisms. The methodology and indicators have been developed and selected on the basis of broad consultation with international health programs experts from leading donor and technical assistance agencies. It is expected that individual health and disease programs will use the findings of a completed DQ to inform their respective detailed assessments of data quality and program-specific information systems. The goal

of the DQ is to contribute to the improvement of the quality of data used by stakeholder for reviews of progress and performance – such as annual health sector reviews, program planning, and monitoring and evaluation – in order to facilitate decision-making (Purba, 2017)

These conditions cause a gap between the existing information and reality. If this data is the only source of information used for decision making, a decision which cannot be accounted for will be produced. The results of research in Nicaragua illustrate the quality of data in the district health information system reaching only 33%. Poor quality of data is also found in health information systems in Indonesia, which is 43.6%. Hartati's research results in Loksamawe district found that the quality of the data in the SP2TP report only reached 27.6%.

According to Lafound, there are three determinant factors that affect the quality of data in a health information system that is organizational, technical and behavioral determinants.. Organizational determinants reflect TB program information management. Technical determinants concern technical factors such as finance, human resources, and technology. Whereas behavioral determinants concern the skills and motivation of TB data recording and reporting officers at the puskesmas.

Organizational determinants reflect TB program information management. Technical determinants concern technical factors such as finance, human resources, and technology. While behavioral determinants concern the skills and motivation of TB data recording and reporting officers at puskesmas.

If the organizational, technical and behavioral determinants are able to improve the quality of the data, then the three determinants are thought to be able to improve the quality of the DOTS data program. If the quality of the DOTS data program can be improved, then the TB data surveillance system can be strengthened. If this hypothesis is tested the factors causing poor quality of data can be identified.

2 METHOD

This research uses descriptive analytic method with Cross Sectional approach conducted in Puskesmas in Deli Serdang and Serdang Bedagai at 50 Puskesmas. Research sample set by using a minimal sampling formula with probability of DOTs Program data with a bad category of 0.23 ($p = 0.23$).

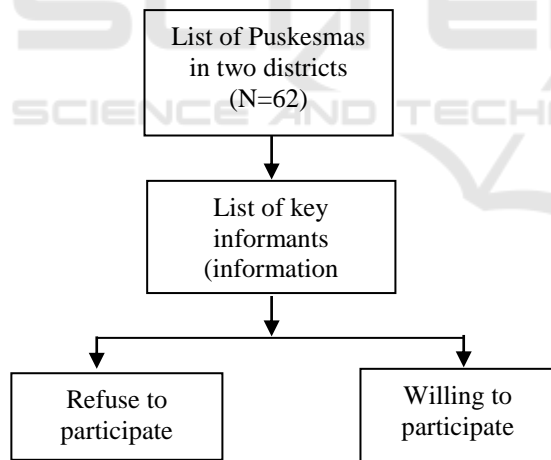


Figure 1: Establishing key information of puskesmas.

Information from 50 DOTs officers was collected with inclusion criteria: work experience ≤ 1 year and exclusion criteria: refusing to participate, and unable. Data was collected using a questionnaire that was compiled based on external validity, face validity, construct validity and reliability. The questionnaire used in this study was first tested by researchers in populations that have almost the same characteristics in different places.

Validity and reliability tests were performed on 3 puskesmas in Deli Serdang and 2 puskesmas in Serdang Badagai. Validity test is done by using Item Corrected Correlation (ICC) at the real level $\alpha = 0.05$ and reliability testing using Cronbach's Alpha method, namely analyzing the reliability of measuring instruments from one measurement with the provisions if the value of $r_{\text{Alpha}} > r_{\text{table}}$, then declared reliable.

The data analysis method is carried out in three stages, namely univariate, bivariate, and multivariate analysis. Bivariate analysis is used to see the relationship between the independent variable and the dependent variable independently with Chi-square (X^2) at the real level $\alpha = 0.05$. While multivariate analysis is used to determine the relationship between independent and dependent variables together using multiple regression tests at the real level $\alpha = 0.05$. A statistical decision is stated on starting H_0 if $p < 0.05$.

The desk review examines data quality across four dimensions: completeness, internal consistency, external comparisons and external consistency of population data. Further, the desk review examines a core set of tracer indicators selected across program areas in relation to these dimensions. The desk review requires monthly or quarterly data by subnational administrative area for the most recent reporting year and annual aggregated data for the selected indicators for the last three reporting years. This cross-cutting analysis of the recommended program indicators across quality dimensions quantifies problems of data completeness, accuracy and consistency according to individual program areas but also provides valuable information on the overall adequacy of health-facility data to support planning and annual monitoring. WHO recommends that the desk review component of the DQ be Desk conducted annually. The desk review compares the performance of the country information system with recommended benchmarks for quality, and flags for further review any subnational administrative units which fail to attain the benchmark. User-defined benchmarks can be established at the discretion of assessment planners (Purba, 2017).

3 RESULTS

This research was conducted in Deli Serdang and Serdang Bedagai in North Sumatra Province. The number of samples in this study were 34 puskesmas at Deli Serdang Regency and were expanded to 16 Puskesmas in Serdang Bedagai to complete the

number of samples in the determined study. Until this research was completed, there were 3 Puskesmas that received the accreditation status and 8 Puskesmas were preparing for accreditation in 2019.

The characteristics of puskesmas data officers in this study showed that the age of DOTS data officers was most often found ≤ 30 years by 76%. Working period <5 years 56%, education is mostly found with the category > 12 years of school by 94%, Participation in data training that has been carried out in the last 2 years is mostly found in the ≤ 2 times category by 74%. The description of the characteristics of DOTS data officers in Deliserdang Regency in 2019 can be seen as in the following table.

Table 1: The characteristic of DOTS data officer in Deli Serdang.

Characteristics of DOTS Data Officers	n	%
Age (Years)		
< 30 years old	38	76
≥ 30 years old	12	24
Years of working		
< 5 years	28	56
≥ 5 years	22	44
Level of education		
≤ 12 years school	3	6
> 12 years school	47	94
Training		
≤ 2 time	37	74
> 2 time	13	26

The results of this study also show the characteristics of health centers in Deli Serdang district with the characteristics of plenary Accreditation of only 2%, while accreditation is good at 8%, and accreditation is sufficient at 24%. While as many as 66% have not been accredited. This health center classification also consists of 78% non-inpatient health center and 22% in-patient health center.

The quality of data produced by the DOTs information system of the Puskesmas program in Deli Serdang is classified as poor where the lowest is found in use of information category by 68%, followed by the data completeness category by 36%, data confidentiality by 34%, data validity by 24%, and on time data delivery in 12%. The use of information from data generated in decision making at the puskesmas level is also still very low. Where only found by 4% with good categories, the rest are in the category of not good enough and poor quality.

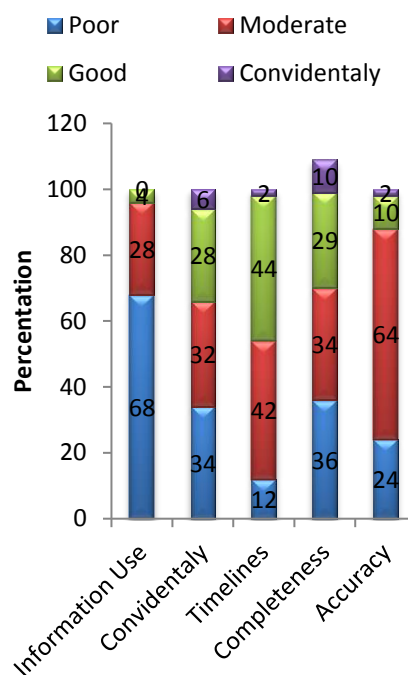


Figure 2: Distribution of data quality system information program DOTs.

The relationship between organizational determinant with the quality of DOTS data shows that the quality of DOTS data at the puskesmas program is mostly found in the organizational determinant category of less 21 (84%) of 25 DOTS officers, higher than the good organizational determinant 13 (52.0%) of 25 DOTS officers and found to be statistically significant with $p = 0.01$ ($p < 0.05$).

Technical factors in the DOTS information system of the puskesmas program are one of the elements that influences the quality of the data. The results of this study indicate that the quality of DOTS data at the puskesmas program is mostly found in the category of technical determinants of less than 25 (78.1%) of 32 DOTS officers, higher than the technical determinant of either 9 (50.0%) of 18 DOTS officers. Statistical analysis showed that there was a significant relationship between technical factors and the quality of DOTS data at the puskesmas program with $p = 0.04$ ($p < 0.05$).

Behavioral determinants show the least quality data found in the category of behavioral determinants of less 20 (80%) of 25 DOTS officers, higher than the determinant of good behavior 14 (56%) of 25 DOTS officers. Statistical analysis showed that there were significant differences in the quality of determinant data of less behavior with

good behavior ($p = 0.06$; $p < 0.05$). This means that there is a relationship between behavioral determinants and the quality of DOTS data at the Puskesmas program in Deli Serdang.

Table 2: Organizational, technical, and behavior determinants with data quality program DOTs.

Category	Data Quality				p-value
	Less		Well		
	n	%	n	%	
Organizational Determinant					
Less	21	84.0	4	16.0	0.018
Well	13	52.0	12	48.0	
Teknikal Determinant					
Less	25	78.1	7	21.9	0.006
Well	9	50.0	9	50.0	
Behavior Determinant					
Less	20	80.0	5	20.0	0.000
Well	14	56.0	11	44.0	

4 DISCUSSION

The relationship of organizational determinants with the quality of DOTS data in Deli Serdang shows the consistency of the results of this study compared to previous studies. Although not many research results have shown the same relationship in the field of information systems, but the results of this study are consistent with measure evaluation research which also finds an organizational determinant relationship with data quality (Ahanhanzo, 2018).

DOTS workers work within the organization of Puskesmas where this organization influences them through the organization's rules, values and practices. The DOTS program in Puskesmas organizations is a health service system and managed by government organizations. Organizational factors such as lack of human and financial resources, low management support, lack of supervision and leadership affect data quality (Kim, 2018).

Organizational determinants are important to influence performance and define this category because all factors are related to organizational structure, resources, procedures, support services, and culture to develop, manage and improve information systems processes and performance.

Information systems enhance evidence-based decision making, manage knowledge and create transparency and good governance without changing the organizational hierarchy. Lippeveld shows that

information systems need to follow the communication channels that exist in the organizational hierarchy (Lippeveld, 2019). Kim in the socio-technical system of information systems emphasizes the measurement of organizational processes of human and technological interactions that lead to the quality of services and products (Hartzema, 2016).

Likewise, Lind stated 'Every system is designed to achieve the results achieved', which shows that performance is a characteristic of the system (Lafound, 2017). Thus, the DOTS information system framework emphasizes that all system components and actors, leaders and workers, are responsible for improving DOTS data quality performance. Leadership roles are seen as role models and facilitate work processes (Adomou, 2017).

Information system performance is indicated by improving data quality and the continuous use of information. Data quality is further described in four dimensions: relevance, completeness, timelines, and accuracy. Relevance is assessed by comparing data collected against management information needs. Completeness is measured not only with respect to all data elements filled out but also the proportion of Puskesmas reports in an administrative area. Timeliness is assessed as a merging of reports within a specified time period. Accuracy is measured by comparing field data and Puskesmas reports, and between Puskesmas reports and data based on administrative regions (Hanefeld, 2018).

The debate that often arises lately concerns the quality and quality of the data used in decision making. The right decision in the determination of health interventions will affect the outcome and performance of the health system (Links, 2018).

The challenges facing our country lately are about good governance, transparency, and accountability which are indicators of development, and their impact is strengthening evidence-based decision-making and information systems that demand quality data. Thus, health information systems require an increase in the quality and use of appropriate information in policy making (Ho, 2018).

In the effort to develop the National Health Information System to support decentralization in the health sector at local and regional levels, various weaknesses were still encountered. Among them is the integration of SIK which is still not good. Each unit tends to collect as much data as possible using each reporting method and format. As a result, the lowest units such as Puskesmas which must record

data and report it become much burdened. The negative impact of these activities is the inaccuracy of data, the slow delivery of data reports, incomplete data and the integrity of puskesmas data so that the quality of data and information produced is poor (Hartzema, 2016).

According to Purba (2018) the performance of information systems depends on the process of gathering information that is influenced by technical, behavioral, and organizational factors. Behavioral factors have a direct influence on information systems processes and performance. Technical and organizational factors influence the information system process and performance directly or indirectly through behavioral factors.

Behavior in health information systems is related to the competencies, motivations, knowledge, experiences, values and attitudes of individuals involved in the system that affect the information system process and directly affect SP2TP performance (Leveled, 2018).

Purba Research (2018) in Medan City found that workload and job responsibilities are related to the performance of the Puskesmas SP2TP coordinator as seen from the completeness of data and on time delivery. Hartati (2016) found a positive and significant relationship between personal factors and the performance of health workers in the implementation of Keluarga Sadar Gizi program in Sukoharjo Regency. According to Mangkunegara in Bienchet (2017) employee performance will be high if motivation is high and supported by high ability. Work motivation is one of the personal factors that influences performance achievement (work performance). Based on McClelland's (1961) research, it was concluded that there was a positive relationship between success motivation and achievement.

In addition to work motivation, other behavioral factors that affect performance are work abilities (knowledge and skills). With adequate education for the position and skilled in doing daily work, then it will be easier to achieve the expected performance. Therefore, employees need to be placed in jobs that match their expertise (Purba, 2018).

The sector of employment was associated with the quality of data in our study. This phenomenon may be explained in this context by the fact that the private sector in Benin is not significantly involved in the RHIS. Support activities such as training and supervision are, therefore, mostly dedicated to the public sector. Moreover, our findings confirm this difference of resources for the RHIS with the difference observed in our sample regarding

supervision and availability of material resources for RHIS. Moreover, it is also interesting to note that despite the fact that the health workers had mentioned unsuitable RHIS training, training and retraining during the previous twelve months could have a positive impact on the quality of data. Improving the quality of training will produce improved results, particularly by tailoring it according to the following three components: the trainer, the health worker being trained and the tool being taught.

Although in our study organizational factors such as the availability of resources, supervision, financial incentives and the perceived complexity of the technical factors were not associated with the quality of the data, from a statistical point of view, the results of the focus group illustrate their role in data quality. This phenomenon is confirmed by the positive relationship found with the training. In the framework of RHIS performance, these factors were more directly linked with behavioral factors nevertheless, some authors have shown a direct positive link between financial incentives and performance. Although this positive relationship between financial incentive and performance is still under investigation, with the experience of results-based financing in many developing countries, including Benin, it would be interesting to look at the issue in greater depth. We could accomplish this goal by incorporating, as a contractual performance result, an indicator for the quality of the data produced by the health center. In light of comments made by health workers in the focus groups, the format of the reporting form (design, number of items to fill, etc.) may need to be addressed. Shorter forms with pertinent items from the health workers' point of view should certainly improve data quality. The main issue would be involving the health workers in the design process because the choice of indicators and thus form items is dependent on national and partner priorities (Purba, 2019).

It would have been worthwhile to perform modelling with adjustments, but taking into account the very low staff numbers in some categories of our sample, we were unable to accomplish this; this is one of the main study limitations. The comparisons made with other studies take into account the methods used in those studies because differences in methods could justify the differences in the findings. The analysis methodology we used together with LQAS sampling and the survival analysis is worthwhile, but it has its limitations, particularly in this study, where we had low staff numbers for certain categories, which made analyses with

adjustment impossible. The simplicity of the LQAS methodology offers the opportunity to reproduce the work with more flexible criteria for evaluating data quality. Moreover, by working with a larger sample, more in-depth analyses could be conducted.

This study identified some factors associated with the quality of the RHIS data. The type of factors identified, such as those linked with the human resources as work engagement, self-perceived efficacy, and organizational factors show that the strategies for data quality improvement must focus on human resources, perhaps more than other resources. Indeed, in our context of limited resources, the first steps taken to improve the performance of RHIS should focus on investments in material and financial resources. Moreover, in a practical way, for example at the operational level, the choice of the staff delegated to data collection could take into account the relationship we found between data quality and the responsibility of the health worker (Purba, 2019). The results of the analysis in this study indicate that there is a relationship between technical determinants and the quality of DOTS data at the Puskesmas Deli Serdang. Akil in his research also found a relationship of technical determinants with data quality in improving information system performance (Ahanhanzo, 2018).

Technical determinants are important factors related to specific knowledge and technology to develop, manage and improve the processes and performance of health information systems. These factors refer to the development of indicators; designing data collection forms and preparing manual procedures such as information technology types such as updated software for data processing and analysis.

Weak technical determinants in the DOTS program in Deli Serdang Regency are caused by the low availability and capability of information technology both by the Puskesmas and DOTS program organizations. According to Lafound computerized technology and the use of communication tools when gathering information will be the way to develop information systems. (Lafound, 2018). Thus, users of information technology in DOTS organizations can effectively increase the knowledge, skills of information technology in DOTS organizations in the future.

In circumstances or regions with inadequate resources, the use of low technology in managing information systems can still achieve acceptable levels of performance. Data quality is very dependent on the type of technology used. Computer

technology and the internet now makes the system of analysis, sending, and the percentage of data easy to do. However, this must be complemented by the competence of users of the system to produce good quality data. If indicators are irrelevant, data collection forms will be very difficult to fill out, and if computer software is not easily applied it will affect the level of accuracy and motivation of implementing health information systems (Khan, 2018).

When the software cannot process data correctly and on time, the resulting analysis does not provide meaningful conclusions in decision making, it will affect the use of information. Therefore, technical determinants can affect performance directly or indirectly through behavioral factors (Adejumo, 2017). The results of this study indicate there is a behavioral relationship with the quality of DOTS data in Deli Serdang Regency. The relationship of behavior as one of the determinants of the quality of health information data has also been recognized by Ahanhanzo (Adejumo, 2017). The same thing was also found in the Measure evaluation in his study in Guanea about health facilities (Lippeveld, 2018).

The results of this study are also supported by studies in the United States that find information system performance that includes data quality and information usage depends on the motivation of information system officers in addition to other factors that influence it (Teklegiorgis, 2016). According to Akil, behavior directly affects the process and data quality. Limited skills and knowledge about data management are the main factors of the low quality of data and information usage (Adejumo, 2017; Ahanhanzo, 2018).

Behavior as a determinant of health information systems concerns self-confidence, motivation, knowledge, attitudes and competencies of DOTS officers in a series of health information systems. Behavior is directly related to a person's feelings towards work and work results.

According to Akil, behavior influences whether or not work will be done (Ahanhanzo, 2018).

One of the main internal factors that influence DOTS officer behavior is motivation. Motivation is defined as a psychological process that provides direct strength and leads to the perseverance of intentional behavior. Attitudes, knowledge, skills and abilities are also important internal factors in behavior. Without the ability a person will not be able to do the work given. Attitudes consisting of beliefs, feelings and the tendency of a person's behavior, influence behavior indirectly through intention or purpose (Ahanhanzo, 2018).

Poor organizational behavior by DOTS officers in Deli Serdang shows poor data performance and quality. This is caused by the low motivation, knowledge, and competence of DOTS organizations in handling data. Utilization of data in decision making is not used properly by Puskesmas leaders. The information system paradigm among officers is an obstacle in improving the quality of information. This will certainly relate to a system of transparency, accountability and decision-making choices for better performance.

Knowledge of the HMIS (Health Management Information System) concepts was found to be associated with better quality of HMIS data and yet this was not true of training on HMIS. This shows that, understanding the basic HMIS concepts might not be related to the basic training on HMIS. It has been reported that often training is not the problem; instead it is probably a manifestation of unwillingness to fill in the forms and lack of commitment and accountability of the poorly supervised health workers. Supervision, regardless of the reported duration, had been shown in this study to have no relationship with improved data completion (Purba, 2018).

This raises some doubts on the quality of supervision provided by Council Health Management Teams (CHMT) to the health facility workers. Except for monitoring the number of visits made by members of CHMT to the facilities, there is no mechanism for measuring and monitoring quality of supervision at health facilities as well as at district level. Thus the onus of ensuring that supervision is done effectively, is left to the supervisor. This study has shown that the presence of HMIS focal person facilitates data processing hence improving the quality of data. However, this study did not go further into assessing the merits and demerits of having an HMIS focal person. Given that team approach is an integral part of Primary Health Care (PHC) strategy delegation of HMIS duties to one person might undermine integration of the system into other programs. Accountability as measured through queries made by district officials on data received from health facilities revealed an association with better quality of data, however, this was not the case with query on delay of reporting. This might indicate that Municipal health workers are keen to receive reports irrespective of their quality in order to satisfy the needs of higher authorities. It has been reported that data is often collected in order to meet bureaucratic obligations rather than performance monitoring (Purba, 2018).

5 CONCLUSIONS

The quality of the DOTs data program at the Puskesmas Deli Serdang is still poor and has not been used as material in making strategic decisions. The results of this study conclude that there is a relationship between behavioral determinants, organizational determinants, and technical determinants with the quality of DOTs data in the Puskesmas Deli Serdang.

6 SUGGESTION

It is recommended to the Deli Serdang District Health Office to conduct data management training to DOT information system management officers routinely (at least once a year) in an effort to improve data quality, information system performance, and TB surveillance performance.

ACKNOWLEDGMENT

This research was supported by Institut Kesehatan Delihusada Delitua, Institut Kesehatan Medistra Lubuk Pakam, Sembiring Hospitel Foundation, and Grand Med Hospital Foundation, Indonesia.

REFERENCES

- Adamou A, Curran J, Wilson, L; GIS for Monitoring Scale-up, US-AID, Measure Evaluation 2017
- Adejumo A, Criss J.,; Assessment of Data Quality in Routine Health Information Systems in Oyo State, Nigeria. Dissertation, University of the Western Cape 2017.
- Ahanhanzo YG, Ouedraogo LT, Kpozehouen A, Copieters Y, Mokoutode M, Faktor Associated with data quality in the Routine Health Information System of Benin. Biomed Central 2018; 72: 25-33
- Akil A, Richadson W., 2016. PRISM framework: a paradigm shift for designing, strengthening and evaluating routine health information systems. Health Policy and Planning Advance.
- Aqil A, Lippeveld T. 2017. Training manual on continuous improvement of HMIS performance: quality and information use; focus on HIV/ AIDS services. MEASURE Evaluation, Guangxi and Yunnan CDC
- Aqil A. Lippeveld T, Yokoyama R. 2017. Yunnan Baseline HMIS Report. MEASURE Evaluation, CDC Yunnan, USAID

- Blanchet, K., Nam, S.L., Ramalingam, B., Pozo-Martin, F. (2017, April) Governance and capacity to manage resilience of health systems: towards a new conceptual framework. *International Journal on Health Policy Management*, 6(8), 431-435. Retrieved from.
- Dewi,S, Sitorus P., 2016; Hubungan Kualitas Data DOTS Program Dengan Peningkatan Kasus Tuberkulosis Di Puskesmas Delitua.*Jurnal Public Health Community STIKes Delihusada Delitua*.
- Hanefeld, J., Mayhew, S., Legido-Quigley, H., Martineau, F., Karanikolos, M., Blanchet, K., ... Balabanova, D. (2018). Towards an understanding of resilience: responding to health systems shocks. *Health Policy Planning*. 33(3), 355-367. Retrieved from.
- Hartati, Dinata T, 2016; Hubungan Perilaku Organisasi Dengan Kualitas Data SP2TP di Kabupaten Aceh Utara, Tesis, Program Studi Kesehatan Masyarakat S2 STIKes Delihusada Delitua.
- Hartzema, Abraham G; Reich, Christian G; Ryan, Patrick B; Stang, Paul E; Madigan, David; Welebob; 2016; Managing Data Quality for a Drug Safety Surveillance System. Proquest
- Ho, K., Al-Shorjabji, N., Brown, E., Zelmer, J., Gabor, N., Maeder, A., Marcelo, A., ... Doyle, T. (2016) Applying the resilient health system framework for universal health coverage. In Maeder, A., Ho, K., Marcelo, A., Warren, J. (Eds.), *The Promise of New Technologies in an Age of New Health Challenges* (pp. 54– 62). Amsterdam, Netherlands: IOS Press BV.
- Khan, Y. O'Sullivan, T., Brown, A., Tracey, S., Gibson, J., Génereux, M., ... Schwartz, B. (2018) Public health emergency preparedness: a framework to promote resilience. *BMC Public Health* 18)1344.
- Kim JH, Yim JJ; Achievements in and Challenges of Tuberculosis Control in South Korea. Seoul National University College of Medicine, Seoul, South Korea 2018; 21: 1913-20
- Kruk, M., Myers, M., Varpilah, S.T., Dahn, B.T. (2015, May). What is a resilient health system? Lessons from Ebola.*The Lancet Viewpoint*. 385(9980), 1910-1912.
- Lafond A, Field R. 2018. The Prism: Introducing an analytical framework for understanding performance of routine health information system in developing (draft). RHINO 2nd International Workshop, South Africa, MEASURE Evaluation
- Lafound, Linda JS, 2017,. Performance of Routine Information Systems Management (PRISM) Tools. Oxford University Press
- Lind A, Lind B. 2016. Practice of information system development and use: a dialectical approach. *System Research & Behavioral Science* 22: 453
- Links, J., Schwartz, B.S., Lin, S., Kanarek, N., Mitrani-Reiser, J., Sell, T.K., ... Kendra J.M. (2017) COPEWELL: A Conceptual Framework and System Dynamics Model for Predicting Community Functioning and Resilience After Disasters. *Disaster Medicine and Public Health Preparedness* 12(1):127-137.
- Lippeveld T, Limprecht N, Gul Z. 1919. Assessment study of the Pakistan Health Management Information System. Government of Pakistan and USAID
- Lippeveld T, Sauerborn R, Bodart C. 2018. Design and implementation of health information systems. Geneva: World Health Organization.
- MEASURE Evaluation, 20017; A Conceptual Framework for Data Demand and Information Use in the Health Sector.
- Mphatswe, W; Mate, K S; Bennett, B; Ngidi, H; Reddy, J; Barker, P M; Rollins, 2016; Improving Public Health Information: A Data Quality Intervention In Kwazulu-Natal, South Africa. ProQuest
- PRISM, 2009; Improving RHIS (Routine Health Information System) Performance & Information Use for Health System Management. US-AID
- Purba BD, 2018; Pengaruh determinan sistem informasi terhadap kualitas data dots program di puskesmas kabupaten deli serdang. Researchgate, https://www.researchgate.net/publication/331198113_pengaruh_determinan_sistem_informasi_terhadap_kualitas_data_dots_program_di_puskesmas_kabupaten_deli_serdang
- Purba BD, 2019; pengaruh sosiaodemografi dan budaya terhadap pencarian pengobatan pasien tuberculosis, Researchgate, https://www.researchgate.net/publication/334989132_pengaruh_sosiaodemografi_dan_budaya_terhadap_pencarian_pengobatan_pasien_tuberculosis
- Ronveaux, O; Rickert, D; Hadler, S; Groom, H, 2016; The Immunization Data Quality Audit: Verifying The Quality And Consistency Of Immunization Monitoring Systems. Proquest
- Teklegiorgis, Kidist; Tadesse, Kidane; Mirutse, Gebremeskel; Terefe, Wondwossen, 2016; Level Of Data Quality From Health Management Information Systems In A Resources Limited Setting And Its Associated Factors, Eastern Ethiopia. ProQuest
- US-AID, 2018.Data Quality Audit Tool. <http://www.cpc.unc.edu/measure>. USA
- WHO, 2016; Tuberculosis Report; WHO, Geneva