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ORIGINAL ARTICLE

INFLUENCE OF EDUCATIONAL INTERACTIVE INTERVENTION TO IMPROVE THE ACCURACY OF DEATH CERTIFICATION AMONG PRIMARY HEALTH CARE DOCTORS IN KARUR AND KRISHNAGIRI, TAMIL NADU, 2024.

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ABSTRACT

INTRODUCTION : Accurate and complete medical certification of cause of death certificates (MCCD) are crucial for the medico-legal handling of individual cases of death. Currently the quality of cause of death certification in forms has been poor. Object of this intervention was to assess the knowledge and enhance the professional skills of the trainees for certifying causes of death.

METHODS : We conducted a quasi-experimental intervention study among doctors in a two days training in two districts in Tamil Nadu 2024 with a before and after design without a control group conducted. Form 4A which is used by registered medical practitioners for certifying non- institutional deaths was filled by doctors before and after cause of death training which was audited using the Bloomberg Medical Certification of Cause of Death MCCD assessment tool was entered in Excel and analyzed using Statistical Package for the Social Sciences(SPSS). All variables were compared using proportions, differences and Mc Nemar's & Fischers exact test for ToT and DLT for completeness, correctness, and minor & major errors.

RESULTS : Overall completeness in filling form 4A increased by 30% in Training of Trainers(ToT) and 19% in District Level Training (DLT). The most notable improvements were in the capture of cause of death (96% in ToT, 98% in DLT) and time intervals (96% in ToT). Legibility errors decreased by over 20% in both systems (ToT: 45%, DLT: 44%). The most significant reduction was in the error of "incorrect or clinically improbable chain of events," which decreased from 57% to 19% in ToT and from 65% to 12% in DLT. When comparing major and minor errors, records with major errors decreased from 57% to 19% in ToT and from 65% to 12% in DLT. Minor errors decreased from 84% to 51% in ToT and from 99% to 58% in DLT. Overall, records with any type of error reduced significantly in both groups (ToT: from 98% to 55%, DLT: from 100% to 58%).

CONCLUSION : The intervention resulted in significant improvements in both the completeness of death certification records and the reduction of errors. These findings highlight the importance of training and its methodology for certifiers in ensuring high-quality and accurate cause-of-death certificates.

KEYWORDS : Medical Certification of Cause of Death, Quasi-experimental study

INTRODUCTION

Mortality statistics are a fundamental component of civil registration and vital statistics (CRVS) and are crucial for public health and policy-making for several reasons such as public health surveillance, resource allocation, policy development, identifying disparities, and epidemiological research.[1] Medical Certification of cause of death (MCCD) is one of the reliable sources for mortality statistics. The gold standard for cause-of-death reporting is for a medical practitioner to certify the cause using the rules and procedures outlined in the International Classification of Diseases, now in its eleventh revision (ICD-11) but ICD-10 is currently used in India.[2] In India as per the Registration of Birth and Death Act, Section 10(3) states that under sub-section (2) a certificate as to the cause of death shall be obtained, in the event of the death of any person who, during his last illness was attended by a medical practitioner, the medical practitioner shall, after the death of that person, forthwith issue without charging any fee, to the person required under this Act to give information concerning the death, a certificate in the prescribed form stating to the best of his knowledge and belief the cause of death; and the certificate shall be received and delivered by such person to the Registrar as the time of giving information concerning the death as required by this Act.[1] Accurate and complete death certificates are crucial for the medico-legal handling of individual cases of death.[3] There are two MCCD forms collected in India. Form 4 is used to collect cause of death for institutional deaths and Form 4A is used for non-institutional deaths.[1]

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The main sections of the form 4A are:

- Part I: This section is for immediate, intermediate, and underlying conditions directly leading to death, known as the primary cause of death.
- Part II: This section records other significant conditions contributing to death but not directly related to the primary cause of death listed in Part I.
- Other Sections: These include the patient's demographic details, the degree of certainty with which the certifier completes the MCCD, the timing of events, the manner of death, and the personal details of the certifier.

Part I captures the sequence of conditions directly causing death. It begins with the immediate cause of death (the final/terminal disease or condition directly resulting in death) on line (i), which is due to (results from) the antecedent (intermediate) condition recorded on line (ii), which in turn results from the underlying cause of death (the disease or condition that initiated all events resulting in death) on line (iii). The condition listed on the lowest line of Part I (iii) is the underlying cause of death. This is considered the initial domino that triggered all subsequent events leading to death and is used for statistical mortality analysis by ICD-10. In Part II, other significant conditions contributing to death but not directly related to the underlying cause are recorded.[1]

Despite its inclusion in medical school undergraduate curricula, the training for documenting death certification is not provided and holds little practical significance at the early stage of medical education.[4-6] Although completing death certificates is a routine and well-standardized task for most physicians, a critical review reveals that these documents frequently contain numerous errors.[7,8]

Research from other regions has revealed that the clinical information recorded on death certificates often fails to construct a logical cause of death. Furthermore, up to 10% of these certificates are completed poorly, and only 55% meet the minimum required standards.[9] Hence, to assess the knowledge and enhance the professional skills in our setting, we conducted a study among the doctors of Karur and Krishnagiri districts by training for certifying causes of death during June 2024.

METHODS

We carried out a quasi-experimental intervention study with a before and after design without a control group. The intervention consisted of two training courses conducted for master trainers – Training of Trainers followed by district-level training for primary healthcare doctors employed in the Department of Public Health and Preventive Medicine (DPH&PM) at Karur and Krishnagiri districts in June 2024. A total of 60 trainees participated in the training of trainers. The participants for the Trainer of Trainers (ToT) were block-level primary health care doctors from the DPH&PM from Karur and Krishnagiri districts, Medical Colleges, Indian Council of Medical Research – National Institute of Epidemiology (ICMR-NIE), WHO, and training institutes (Institute of Public Health, Health & Family Welfare Training Centre, Health Manpower Development Institute). The doctors from the training of trainers have served as master trainers and conducted the district-level training (DLT) at Krishnagiri and Karur for the doctors of each primary health center from the same district. 102 trainees participated in district-level training who were from each primary health centre from Karur and Krishnagiri districts.

Training methodology: The training was structured in such a way that a pre-test was given along with form 4A with a case scenario and the doctors were asked to fill the form. The training was tailor-made specifically for the doctors emphasizing the importance of MCCD and how to use it based on the previous experiences in the field and training done under the District CRS Approach program. The scenario for form 4A was taken from the Physician Manual on Medical Certification of Cause of Death provided by the Office of Registrar General of India. The trainees were trained on Medical Certification of cause of death for 2 days through PowerPoints (4 hours), group work(4 hours) and hands-on training (2 hours) elaborating the contents of MCCD and the pitfalls while writing MCCD, discussion of case studies with different scenarios, and how to write the cause of death in the prescribed MCCD form in English language and were provided with training manuals for future reference. The doctors after the training will be provided with a cause of death form in their PHC from the history collected by their concerned Health Inspectors from the field. The doctors were requested to fill out a post-test along with form 4A with the same case scenario at the end of the training. The Form 4A from the pre and post-test of Training of trainers and district-level training were collected as hard copies by the State Nosologist from the State Bureau of Health Intelligence (SBHI) section of the Directorate of Public Health and Preventive Medicine. Each form 4a was assessed using the Bloomberg MCCD assessment tool manually. It was noted in ToT out of 60 participants pre-test was received from 51 participants only and post test was received from 47 participants only. All 102 participants from District Level training provided the pre-test and post-test.

The form 4A after assessment using the tool mentioned above was entered in MS Excel and analysed using SPSS. The variables such as gender, age, cause of death, time intervals, and practitioner details were compared with pre-test and post-test using proportions for completeness and correctness. The errors in form 4 A were categorized as major and minor errors.

The major errors (Mechanism of death listed without an underlying cause & Improper sequencing) and minor errors (Abbreviations, Absence of time intervals, Absence of Age, address, date & time of deceased) were compared. The differences of percentages between pre-test and post-test were compared for both ToT and DLT. The pre-test and post-test of ToT were compared using Mc Nemar's test and Fischer's exact test.

Our study got approved by Institutional Ethics Committee of Tamil Nadu Public Health department; we maintained privacy and confidentiality in such a way that no personal data was used or revealed during analysis or report preparation & presentation.

RESULTS

The intervention was carried out among 162 participants (ToT-60(37%), DLT-102(63%)). A total of 302 records of which 98(32%) ToT records (51 pre- test, 47 post-test and 22 records not received) and 204 (68%) (Krishnagiri:130(64%), Karur:74(36%)) DLT records were audited.

The completeness of the variables (age, gender, date, time and address of deceased, name, date and signature of certifier, cause of death, part 2, time intervals availability) were assessed for all these records. Six errors (multiple causes, abbreviations, illegibility, Incorrect or clinically improbably chain of events, impossible underlying cause, certifier name not legible) from form 4A was assessed.

It was noted that completeness for all the variables in ToT had increased in the post-test when compared with the pre-test. The certifier's name was least captured (57%) in the post-test among all the variables in ToT. The cause of death and time interval variable was captured higher (96%) in the post-test in ToT. Overall completeness was improved by 30% in ToT and statistically significant. It was noted that one error "impossible underlying cause entered in the lowest used line of part 1" was nil among the available records captured. Legibility was the most noted error in pre-test of ToT(71%) which improved by more than 26% in ToT(45%) . The error "incorrect or clinically improbably chain of events leading to death in part 1" was improved the highest among all errors in ToT (pre-test-57%, post-test-19%).

Overall errors among certification have improved by 38% in post-test by 26%(ToT). It was noted that the records with at least one major error reduced in ToT (pre-test-57%, post-test-19%) and records with at least one minor error also reduced in ToT (pre-test-84%, post-test-51%). The records when taken with any one of the major or minor errors was noted that error reduced by 43% in ToT (pre-test-98%, post-test-55%) and statistically significant (Table 1).

Table 1: Completeness of variables & errors in the form 4A captured during pre-test and post-test of the ToT

Variable	ToT		% Diff	p-value
	Pre-test (n=51)	Post-test (n=47)		
Completeness of variables in the form 4A				
Age of deceased recorded n(%)	40(78%)	39(83%)	5	<0.001
Gender of deceased recorded n(%)	38(75%)	36(77%)	2	0.002
Date of Death of deceased recorded n(%)	44(86%)	42(89%)	3	<0.001
Time of Death of deceased recorded n(%)	44(86%)	44(94%)	8	0.3218
Address of Death of deceased recorded n(%)	36(71%)	40(85%)	14	0.001
Date of certification recorded n(%)	24(47%)	30(64%)	17	0.791
Name of Certifier recorded n(%)	16(31%)	27(57%)	26	0.374
Signature of Certifier recorded n(%)	27(53%)	33(70%)	17	0.289
Cause of death recorded in form n(%)	48(94%)	45(96%)	2	1
Part 2 recorded in form n(%)	28(55%)	40(85%)	30	0.044
The time interval of any illness recorded in any of line n(%)	33(65%)	45(96%)	31	0.0001
The time interval of any illness recorded in all line n(%)	9(18%)	39(83%)	65	0.824
Overall certification without missing any variables	2(4%)	16(34%)	30	0.0001
2.Errors noted in the form 4A				
Multiple causes recorded in any line in Part 1 n(%)	18(35%)	9(19%)	16	<0.001
Abbreviation used in entries in any of the lines n(%)	27(53%)	15(32%)	21	0.2
Illegible Handwriting recorded in form n(%)	24(47%)	15(32%)	15	0.09
Incorrect or clinically improbably chain of events leading to death in part 1 n(%)	29(57%)	9(19%)	38	0.031
Impossible underlying cause entered in the lowest used line of part 1 n(%)	0(0%)	0(0%)	0	<0.001
Certifier name, not legible n(%)	36(71%)	21(45%)	26	0.405
Overall certification with any one of the above-mentioned errors n(%)	50(98%)	34(72%)	26	0.0001
3. Major & Minor Errors noted in the form 4A				
At least one Major errors n(%)*	29(57%)	9(19%)	38	0.031
At least one Minor errors n(%)**	43(84%)	24(51%)	33	0.008
Overall certification with any one of the above-mentioned errors (Major or Minor)	50(98%)	26(55%)	43	0.0001

* Major errors - Mechanism of death listed without an underlying cause & Improper sequencing

** Minor errors – Abbreviations, Absence of time intervals, Absence of Age, address, date & time

It was noted that completeness for all the variables in DLT increased in the post-test when compared with the pre-test. The time interval in all lines was the least captured (57%) in the post-test in DLT, and it was one of the highest variables that was improved in the post-test by 51%. The cause of death variable was captured higher (98%) in DLT.

Overall, completeness was improved by 19% in DLT, and this improvement was statistically significant. It was noted that one error "impossible underlying cause entered in the lowest used line of part 1" was nil among the available records captured. Legibility was the most noted error in the pre-test of DLT(74%) which improved by 30% in DLT(44%).

Table 2: Completeness of variables & errors in the form 4A captured during pre-test and post-test of the DLT

Variable	DLT		% Diff	p-value
	Pre-test (N=102)	Post-test (n=102)		
Completeness of variables in the form 4A				
Age of deceased recorded n(%)	75(74%)	87(85%)	11	0.05
Gender of deceased recorded n(%)	70(69%)	88(86%)	17	0.001
Date of Death of deceased recorded n(%)	81(79%)	97(95%)	16	0.000
Time of Death of deceased recorded n(%)	80(78%)	91(89%)	11	0.03
Address of Death of deceased recorded n(%)	86(84%)	92(90%)	6	0.2
Date of certification recorded n(%)	46(45%)	75(74%)	29	0.000
Name of Certifier recorded n(%)	25(25%)	63(62%)	37	0.000
Signature of Certifier recorded n(%)	58(57%)	81(79%)	22	0.000
Cause of death recorded in form n(%)	92(90%)	100(98%)	8	0.02
Part 2 recorded in form n(%)	39(38%)	83(81%)	43	0.000
The time interval of any illness recorded in any of line n(%)	38(37%)	95(93%)	56	0.000
The time interval of any illness recorded in all line n(%)	6(6%)	58(57%)	51	0.000
Overall certification without missing any variables	2(2%)	32(31%)	29	0.000
2.Errors noted in the form 4A				
Multiple causes recorded in any line in Part 1 n(%)	48(47%)	37(36%)	11	0.1
Abbreviation used in entries in any of the lines n(%)	63(62%)	52(51%)	11	0.06
Illegible Handwriting recorded in form n(%)	48(47%)	36(35%)	12	0.08
Incorrect or clinically improbably chain of events leading to death in part 1 n(%)	66(65%)	12(12%)	54	0.000
Impossible underlying cause entered in the lowest used line of part 1 n(%)	0(0%)	0(0%)	0	0.000
Certifier name, not legible n(%)	75(74%)	45(44%)	30	0.000
Overall certification with any one of the above-mentioned errors n(%)	101(99%)	86(84%)	15	0.000
3. Major & Minor Errors noted in the form 4A				
At least one Major errors n(%)*	66(65%)	12(12%)	53	0.000
At least one Minor errors n(%)**	101(99%)	59(58%)	41	0.000
Overall certification with any one of the above-mentioned errors (Major or Minor)	102(100%)	59(58%)	42	0.000

* Major errors - Mechanism of death listed without an underlying cause & Improper sequencing, ** Minor errors – Abbreviations, Absence of time intervals, Absence of Age, address, date & time of deceased.

The error "incorrect or clinically improbably chain of events leading to death in part 1" was improved by 54%, the highest among all errors in DLT (pre-test-65%, post-test-12%). Overall errors among certification have improved in post-test by 15%(DLT).

It was noted that the records with at least one major error reduced in DLT (pre-test-65%, post-test-12%), and records with at least one minor error also reduced in DLT (pre-test-99%, post-test-58%).

The records when taken with any one of the major or minor errors was noted that error reduced in DLT (pre-test-100%, post-test-58%)

DISCUSSION

This study aimed to assess the completeness and accuracy of death certification records through a training intervention. A total of 162 participants were included, and 302 death certification records were audited before and after the intervention. The results indicated a significant improvement in both the completeness of recorded variables and the reduction of errors in death certification. Effective utilization of electronic media, coupled with self-study resources and reinforced through interactive learning and audit/feedback mechanisms, is essential for achieving broad coverage and fostering significant improvements in the accuracy and reliability of cause-specific mortality data(10). The intervention in the form of interactive workshops, and seminars has proved to be a successful way to improve the cause of death certification process(11)(12)(13)(14) and the same has been noted in our study.

The completeness of key variables such as age, gender, date, time, and address of the deceased, as well as information about the certifier and cause of death, showed significant improvement following the intervention. In the ToT records, overall completeness increased by 30%, while the DLT records showed a 19% improvement. This suggests that the intervention was effective in enhancing the documentation of critical information, ensuring more accurate and reliable death certificates. This will in turn improve the quality of cause of death reporting which will help the district and state to have better mortality indicators. In both ToT and DLT, the most notable improvements were observed in the capture of the **cause of death** and **time interval** variables, with both variables achieving a high capture rate of 96% or more in post-test records. This is a positive finding, as accurate recording of these variables is crucial for public health data, mortality statistics, and epidemiological research. However, certain areas showed relatively lower rates of improvement. The **certifier's name** was the least captured variable in the ToT (57%) post-test, and the **time interval** was the least captured in the DLT (57%) post-test. These persistent gaps highlight areas that might require additional focus in future interventions, such as encouraging certifiers to include all required details systematically.

The intervention demonstrated a significant reduction in errors across both ToT and DLT groups. Legibility was one of the most common errors in the pre-test, affecting 71% of ToT records and 75% of DLT records. Following the intervention, the incidence of illegibility decreased dramatically, with improvements of over 20% in both groups (45% in ToT, and 44% in DLT). This suggests that improving legibility through training and standardization may be an effective strategy for ensuring the accuracy of death certification. Of particular note, the error concerning the "incorrect or clinically improbable chain of events" was significantly reduced. In the ToT group, this error decreased from 57% in the pre-test to just 19% in the post-test, and in the DLT group, it decreased from 65% to 12%. A study done during 2009 comparing various interventions undergone to improve quality of MCCD has reported that seminars and interactive workshops helps in decreasing the error proportions in writing cause of death (10). This improvement suggests that the intervention successfully addressed a critical issue in death certification, ensuring that the chain of events leading to death is both plausible and properly documented.

The analysis of major and minor errors revealed that both types of errors decreased substantially following the intervention. Major errors, such as listing the mechanism of death without an underlying cause or improper sequencing of events, were reduced in both ToT (from 57% pre-test to 19% post-test) and DLT (from 65% pre-test to 12% post-test). This is a noteworthy improvement, as such errors can significantly affect the quality and utility of death data. Similarly, the occurrence of minor errors, such as missing time intervals, age, address, or the certifier's name, also showed a marked reduction. In ToT records, the rate of minor errors decreased from 84% to 51%, and in DLT records, it decreased from 99% to 58%. These reductions suggest that the intervention helped certifiers pay closer attention to the details of the death certification process.

LIMITATIONS

The pre-post assessment of the participants immediately after the intensive focused training only captures short-term changes in the knowledge or skills of the participants. It does not assess the long-term retention of knowledge, cognitive changes, or sustained improvement in clinical decision-making. In this intervention, participants evaluated their learning which can lead to self-report bias, where individuals could have overestimated their cognitive or improvement in clinical decision-making due to the nature of the training or desire to appear competent.

CONCLUSION

The intervention resulted in significant improvements in both the completeness of death certification records and the reduction of errors. These findings highlight the importance of training and its methodology for death certifiers in ensuring high-quality and accurate documentation of cause-of-death certificates. By addressing the gaps in documentation and reducing errors, such type of interventions can enhance the reliability of mortality data, which is essential for health policy planning, epidemiological studies, and public health strategies. It is recommended to extend the evaluation period beyond pre- and post-training to assess long-term retention and sustained impact. Follow up with participants several months after training to evaluate how well they've applied the learned decision-making skills in real-world settings.

CONFLICT OF INTEREST

None

REFERENCES

1. Physicians Manual on Medical Certification of Cause of Death. Office of The Registrar General, India Government of India, Ministry of Home Affairs, 2 A, Man Singh Road, New Delhi. Available from: https://ncdirindia.org/emor/Download/ Physician's_Manual_MCCD.pdf.

2. Rasika Rampatige, Lene Mikkelsen, Bernardo Hernandez, Ian Rileya, Alan D Lopez, Systematic review of statistics on causes of deaths in hospitals: strengthening the evidence for policy-makers Bull WHO 2014(92):807–816

3. Huffman GB. Death certificates: why it matters how your patient died. Am Fam Physician 1997; 56:1287e8, 90.

4. Maudsley G, Williams EM. Death certification by house officers and general practitioners — practice and performance. J Public Health Med 1993;15(2):192-201.

5. Pain CH, Aylin P, Taub NA, Botha JL. Death certification: production and evaluation of a training video. Med Educ 1996;30(6):434-9.

6. Barber JB. Improving the accuracy of death certificates. J Natl Med Assoc 1992;84(12):1007-8.

7. Assessment of Medical Certification of Cause of Death in Two Institutions (X & Y) of a District from Tamil Nadu, 2022. (2023). Tamil Nadu Journal of Public Health and Medical Research, 3(4), 36–37. https://tnjphmr.com/article/pdf/547.pdf

8. Tai DYH, El-Bilbeisi H, Tewari S, Mascha EJ, Wiedemann HP, Arroliga AC: A study of consecutive autopsies in a medical ICU. A comparison of clinical cause of death and autopsy diagnosis.Chest 2001, 119:530-536.

9. Tuffin R, Quinn A, Ali F, Cramp P. A review of the accuracy of death certification in the intensive care unit and the proposed reforms to the Coroner's system. J Iran Chem Soc. 2009(10):134–137

10. Aung E, Rao C, Walker S. Teaching cause-of-death certification: lessons from international experience. Postgrad Med J. 2010 Mar;86(1013):143-52. doi: 10.1136/pgmj.2009.089821. PMID: 20237008.

11. Lakkireddy DR, Basarakodu KR, Vacek JL, et al. Improving death certificate completion: a trial of two training interventions. J Gen Intern Med 2007;22:544e8.

12. Myers KA, Farquhar DR. Improving the accuracy of death certification. CMAJ 1998;158:1317e23.

13. Myers KA, Eden D. Death duties: workshop on what family physicians are expected to do when patients die. Can Fam Physician 2007;53:1035e8.

14. Villar J, Perez-Mendez L. Evaluating an educational intervention to improve the accuracy of death certification among trainees from various specialties. BMC Health Serv Res 2007;7:183.