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ORIGINAL RESEARCH

Differentials, barriers and enablers of death registration in Nepal: evidence from the Civil Registration and Vital Statistics (CRVS) survey

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Abstract

Death registration in Nepal is incomplete, which limits its utility as a routine source of mortality data to inform policy development. This study uses data from the Civil Registration and Vital Statistics (CRVS) Survey 2015/16 in Nepal conducted among households and CRVS service providers (local registrars) to assess the likelihood of death registration, using logistic regression with covariates of socio-economic, demographic and geographic characteristics. Respondents' main reasons for registration and non-registration of deaths and ways to improve the CRVS system are also analysed. Death registration (70%) was more likely where the decedent was male (77%) versus female (60%), older aged (45 years and above 70%) versus young aged (0–14 years 26%) or died of injuries (more than 70%) compared with maternal causes (12%), where the household head's education was higher and where the household haf more communication facilities. There were also large differences death registration by province and for certain ethnic groups. The main reasons for death registration were to transfer property entitlements, access social security or for other legal processes (a combined 85% of registered deaths). The major reason for non-registration of deaths according to most households (72%) and service providers (70%) was that it was not necessary. Both households and service providers stated that registration would be made more convenient by arranging mobile teams for registration, allowing registration at place of occurrence, and promoting online registration. The barriers and enablers identified in this study are valuable evidence to inform CRVS strengthening efforts in Nepal and other countries facing a similar challenge of incomplete death registration.

Keywords Civil registration and vital statistics (CRVS) system · Death registration · Completeness of registration · Mortality · Survey · Service providers · Nepal

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Introduction

Civil registration and vital statistics (CRVS) systems perform important functions to ensure legal identity and to provide timely vital statistics. Legal identity not only enables individuals to access entitlements and services but also protects against exploitation and hardships during emergencies (AbouZahr, de Savigny, Mikkelsen, Setel, Lozano, Nichols et al., 2015; Setel et al., 2007; University of Melbourne Knowledge Gateway, 2018). Accurate vital statistics provide important data on all-cause mortality and causes of death, which serve as an evidence base for public health policies aimed at attaining better health outcomes (Lopez et al., 2020; Phillips et al., 2015). Hence, a well-functioning CRVS system is an important source of reliable evidence for assessing the progress of national and international health goals. However, despite their inherent importance across multiple sectors, CRVS systems in many low- and middle-income countries are only partially functional, and a global assessment of death registration found that only 59% of all deaths were registered in 2015 (Dicker et al., 2018). The development of a high quality CRVS system is challenging, requiring strong coordination of multiple stakeholders that need to work across a wide range of sectors.

In Nepal, a CRVS system has existed since the promulgation of the Civil Registration Act and Regulations in 1975, but it has primarily focused on legislative and administrative objectives rather than use of its data for statistical purposes (Pandey & Adair, 2022). A global assessment of CRVS data up to 2012 could not measure the performance of Nepal's CRVS system because there was insufficient available data (Mikkelsen et al., 2015). The data that have been produced by the CRVS system over several decades have remained unused for statistical purposes, and health policy has instead relied on censuses and surveys for mortality and fertility statistics (Pandey & Adair, 2022). Nepal has however committed to improving its CRVS system through implementation of several initiatives, including implementing a national CRVS Strategy in 2019 (Department of National ID and Civil Registration, 2019).

In Nepal, deaths can only be notified into the CRVS system by an authorized person (immediate family member). Deaths must be registered within 35 days of occurrence, but deaths are often registered after this deadline because of a flexible legislative provision with nominal late registration fee (less than US$2) (Nepal Law Commission, 2020; Pandey, 2022). Deaths are registered based on the place of residence. The CRVS system presently comprises two parallel systems: the paper-based traditional offline system and a more recently developed computer-based online system. The offline system operates throughout the country but has low utility from a statistical perspective because only limited aggregated data are sent from local registration offices to central authorities. Hence, data by age at death and year of death are unable to be compiled. The online system commenced in Nepal in 2015 and covers 40% of the population and is gradually replacing the traditional offline system along with the improved accessibility of local registration offices (Nepal Law Commission, 2020; Department of National ID and Civil Registration, 2021; Pandey, 2022). The online system can hence be used to produce more comprehensive and timely reports that are more useful for statistical purposes compared to the offline paper-based system. There is also no routine cause of death data produced by the CRVS system and

the only data collected are what is reported by the notifier using the death certificate issued by the physician to report the cause of death. An overview of death registration procedures is presented in Supplementary Table 1.

An assessment study estimated that around 69% of all deaths in Nepal in 2017 (male 73%, female 65%) were registered via the offline system and 32% of deaths in 2019 were registered via the online system (Pandey & Adair, 2022). There is significant geographical diversity in completeness; for example, in 2017 offline death registration completeness by province ranged between 39% (Karnali) and 92% (Gandaki) and completeness by ecological belt ranged between 63% (Terai) and 78% (Hill) (Pandey & Adair, 2022). The geographic areas with higher completeness were more urbanized and of higher average socio-economic status. In the online death registration system, child deaths were found to be least likely to be registered (Pandey & Adair, 2022). Further detail about the provinces and ecological belts in Nepal are shown in Supplementary Information.

However, very little is known about how death registration completeness differs by age, cause of death and socio-economic status, as well as the reasons for registration and non-registration of deaths; such information is not provided by the offline death registration data. The CRVS Survey 2015/16 was conducted in Nepal to obtain evidence on these issues using data collected from households and CRVS system service providers (i.e. local registrars and ward secretaries) to inform interventions to strengthen the CRVS system. This study aims to use the CRVS Survey data to:

- identify how the registration of a death is associated with the characteristics of the decedent and death, and geographic and socio-economic factors,
- assess reasons for registration of deaths from the perspective of households, and.
- examine reasons for non-registration of deaths and ways that registration could be made more convenient, according to households and service providers.

Given the findings of Pandey and Adair (2022) described above, we hypothesise that registration will be more likely for male deaths, older deaths, deaths in urban areas and deaths among higher socio-economic groups.

Methods

This study is based on analysis of the results of the CRVS Survey 2015/16 in Nepal. According to the 2011 Population Census, Nepal's total population was 26,494,504, with a sex ratio of 94.16 males per 100 females. The population increased to 29,164,578 in 2021 with slight rise in the sex ratio to 95.59 males per 100 females. Similarly, the number of households rose from 5,427,302 in 2011 to 6,666,937 in 2021 (National Statistics Office, 2023). The CRVS Survey was undertaken to collect a comprehensive dataset of CRVS indicators to inform implementation of the UNESCAP Regional Action Framework in Nepal, inform a national CRVS Strategy, set national CRVS goals and measure progress towards their achievement (United Nations Economic and social Commission for Asia and the Pacific (UNESCAP), 2020). The CRVS Survey was conducted by the Central Bureau of Statistics on

behalf of the Department of Civil Registration. The survey report has been published by the Department of National ID and Civil Registration (Department of National ID and Civil Registration, 2020).

The survey covered the status of six vital events - birth, death, marriage, migration, divorce and adoption. It was nationally representative, comprising 80,000 households (within which there were 498,779 people: 245,964 males and 252,815 females), selected randomly from 1,600 Enumeration Areas, which were selected from 16 analytical domains comprising existing 15 eco-development regions (a cross-section of the contemporaneous five development regions and three ecological belts) and with a separate domain comprising three districts of Kathmandu valley. The Central Bureau of Statistics (CBS) Nepal conducted the CRVS Survey on behalf of the Department of Civil Registration (DOCR). The survey was conducted in two phases: the first phase was conducted in 2015/16 in 16 districts of Mountain ecological belt and the second phase was conducted in 2016/17 in the remaining 59 districts of Hill and Terai ecological belts. Interviewers were social mobilizers working at the local level under the Ministry of Federal Affairs and Local Development. Further information about the survey, including the sample and conversion from the Nepali to Gregorian calendar is provided in Supplementary Information.

Two separate questionnaires were administered as part of the CRVS Survey: one for households and another for service providers (local registrars and ward secretaries). A household refers to a single person living alone or a group of persons, who may or may not be related, usually living together in a particular housing unit and share income for meal and other expenses (Central Bureau of Statistics, 2015). The survey asked households to report any deaths of household members that occurred within the three years prior to the survey date (i.e. 2013/14 to 2015/16). A previous analysis of these data has estimated that these reported deaths comprise 75% of deaths that occurred in Nepal in 2015 and 54% in 2014 (Supplementary Table 2) (Pandey & Adair, 2022). For each death, respondents were asked questions about whether the death was registered, reasons for registering or not registering the death, and factors that would make registration easier (all quantitative data – variables are shown in Supplementary Table 2). The survey also collected information on demographic characteristics of the deceased and socio-economic characteristics of the household, including house construction, household head's education attainment and occupation, and household access to different communication facilities.

The CRVS Survey also comprised a service provider questionnaire conducted amongst 337 local registrars and ward secretaries working at local registrars' offices within the CRVS system. The service provider questionnaire was conducted in the Hill and Terai ecological belts only, which comprise 43% and 50% of the population of Nepal, respectively, with the least populous ecological belt of Mountain ecological belt excluded. The service provider questionnaire asked a series of questions about the registration of all vital events – not only deaths, but births, marriages, divorces, adoptions and migration. These questions included the extent to which events are registered within the legal time frame (35 days) after occurrence, reasons why events are not registered on time, and possible ways for enhancing the effectiveness of event registration at the local level (analysis of some of these could not be included in this manuscript due to space constraints). The questionnaire also collected information

about the demographic characteristics of service providers, their education, employment experience in the CRVS system, training received and information technology (IT)/computer literacy. For both the household and service provider questionnaires, a list of variables used in this manuscript are given in Supplementary Table 1.

Two analyses were conducted in this study. Firstly, we compared the reported completeness of death registration in the CRVS Survey (i.e., the percentage of survey household deaths that were reported to have been registered) to estimated completeness of death registration in 2014 and 2015 based on offline data in the CRVS system, which was calculated using the empirical completeness method and published elsewhere (Adair & Lopez, 2018; Pandey & Adair, 2022). The offline registration data used available for three years (2013/14-2015/16) according to the Nepali calendar year (14 April-13 April of the following year), and we estimated the completeness for Gregorian calendar years 2014 and 2015 after making adjustments described elsewhere (Pandey & Adair, 2022). This comparison was conducted to assess how well reported registered completeness in the survey reflects actual death registration in the CRVS system. This analysis was conducted nationally, by year of death, and for each province and ecological belt. Bagmati province and the Mountain and Hill ecological belts were excluded from analysis due to the severe impact of the 2015 earthquake in those regions (further detail is provided in Supplementary Information) The different sources of completeness used in this study are described in Supplementary Information.

Next, the reported completeness of death registration was analysed by variables representing demographic (age and sex of the deceased), geographic (provinces, ecological belts and urban/rural status), death (place of death, cause of death) and socio-economic (education, occupation, house construction, communication facility and ethnicity) characteristics. Information about ethnic groups is shown in the Supplementary Information. Chi-squared analysis was used to assess whether there was a statistically significant association of these variables with whether the death was reported to be registered, with statistical significance determined by a p-value of less than 0.05. We then conducted binary logistic regression using StataSE 17 software as multivariate analysis to measure the association of these covariates with reported death registration, again using a p-value of less than 0.05 to determine statistical significance (StataCorp, 2021). The standard errors of the odds ratios account for clustering of deaths in the household due to common shared characteristics; otherwise, they may be under-estimated due to the assumption of independence of observations. Regressions were conducted in a stepwise manner; firstly, demographic and geographic characteristics, then adding characteristics of the deceased and death, then for all variables. We also conducted the regression with all variables separately by age of the deceased (less than 65 years, 65 years and above) to assess whether the variables predicted death registration differently by age. The reasons for why deaths were registered or not registered, as provided by the household, were also analysed by the above demographic, geographic, death and socio-economic variables. In addition, we analysed household responses about the ways to make registration more convenient and the service provider responses about the ways that registration of vital events could be made easier and why people do not register vital events.

Results

Comparison of death registration completeness in CRVS survey and offline CRVS system

Reported death registration completeness from the CRVS Survey and estimated offline registration completeness from the CRVS system were reasonably similar at the national level for males in 2015 (survey 64%, offline registration 67%) but estimated offline completeness was higher in 2014 (survey 68%, offline registration 74%). For females, the estimated level of offline registration completeness was 8% points higher than the survey reported death registration completeness in 2015 (survey 50%, offline registration 58%) and almost 20% points higher in 2014 (survey 48%, offline registration 67%) (Supplementary Fig. 3, Supplementary Table 3). There was a strong positive correlation at the province level between death registration completeness reported in the CRVS Survey reported and estimated in offline system, while for ecological belts there was a strong correlation for males but less so for females. Further description of these results is provided in the Supplementary File.

Bivariate and multivariate analysis

Table 1 presents the bivariate analysis in the form of the reported death registration completeness in the CRVS Survey according to the different characteristics. A lower proportion of deaths were reported to be registered if the deceased was younger (0–14 years 26%) compared with older (45 years and over 70%; $p<0.01$) or died of maternal causes (pregnancy / childbirth / unable to give birth 12%) compared with died of accidents (77%), suicide (73%), disease (70%) or natural disaster (76%). Reported death registration was also lower where the household head was illiterate (63%) versus having attained higher education (84%) and where the household had no communication facilities (61%) compared with three or more (79%). Reported death registration by province ranged from 59% in Karnali to 82% in Bagmati and by ethnic group from 53% for Madeshi/Terai caste to 78% for Newars. Table 2 shows that that in all provinces except Bagmati (males 45%, females 60%, both sexes 57%), reported registration completeness at ages 0–14 years was less than 40%. In Madhesh, only 15% of male and 5% of female deaths aged 0–14 years were reported to be registered. Within each age group in each province, male registration completeness was statistically significantly higher than female completeness, except for Karnali, Bagmati and Koshi for ages 0–14 years where it was statistically significantly higher for females than males.

Logistic regression analysis of death registration completeness confirms that the odds of deaths of females being registered were far less likely than for males (odds ratio (OR) = 0.375, 95% confidence interval (CI) 0.321–0.437), and the odds of deaths at ages 15 years and above were far greater for deaths at ages less than 15 years (65–74 years OR = 12.193, 95% CI 8.730-17.031) (Table 3). Compared with Koshi, the odds of registration in Bagmati (OR = 1.542, 95% CI 1.141–2.083) province was greater while in Madhesh (OR = 0.585, 95% CI 0.441–0.777), Karnali (OR = 0.507, 95% CI 0.368–0.698) and Sudurpashchim (OR = 0.548, 95% CI 0.405–0.742) it was

Table 1 Reported death registration completeness (%) by demographic, socio-economic and death characteristics, Nepal, CRVS Survey, 2013/14-2015/16

Categories	Reported completeness (%)	Categories	Reported completeness (%)	Categories	Reported completeness (%)
All (Nepal)	69.6	Cause of death**		Household head age-group*	
Ecological belt**		Disease	70.6	10–34 years	66.7
Mountain	68.2	Pregnancy / childbirth / unable to give birth	11.6	35–44 years	70.4
Hill	76.2	Malnutrition	30.7	45–54 years	69.3
Terai	63.6	Accidents	77.1	55–64 years	69.7
Urban / rural**		Suicide	72.9	65+years	73.2
Urban	78.0	Natural disaster	75.9	**Household head educational attainment****	
Rural	68.1	Unknown	57.4	Primary (Class 1–7)	65.1
Province**		Other	75.5	Secondary (Class 8–12)	74.4
Koshi	74.0	**Place of death ****		Higher education (Bachelor's +)	84.4
Madhesh	53.5	House	69.1	Other academic degree and literate (including informal education)	68.8
Bagmati	81.5	Health facility	70.5	Illiterate	63.3
Gandaki	80.8	Abroad	70.6	**Household head's occupation****	
Lumbini	71.6	Other	74.5	Armed force, admin, and technical works	83.3
Karnali	58.8	**Broad caste/ethnic groups****		Business, service, and factory workers	69.1
Sudurpashchim	64.5	Caste Origin: Hill Groups (Khas_Aryan)	75.1	Skilled workers in agriculture, forestry and fishing	67.9
Sex of deceased**		Hill Adibasi/Janajati groups	70.4	Household work	69.8
Male	77.2	Newar	77.8	Student and have no work	66.9
Female	59.8	Madhesi (Terai Caste)	52.6	**Household head's sex****	
Age group of deceased**		Other	59.8	Male	65.7
0–14 years	25.7	**Household communication facilities****		Female	78.3
15–44 years	63.7	None	61.3	N (Unweighted)=4,532	
45–64 years	72.9	1–2 facilities	66.7	N (Weighted)=3,06,072	
65–74 years	75.3	3+facilities	79.1	Chi-squared statistical significance (p-value): * less than 0.05, ** less than 0.01.	
75+years	77.0				

Supplementary Table 1 presents more detail of questions asked in the survey

lower, and in Lumbini and Gandaki were not statistically significant. Urban/rural status of the household did not significantly predict death registration. Compared with a death caused by a disease, pregnancy / childbirth / unable to give birth predicted lower odds of registration (OR=0.276, 95% CI 0.109–0.697), while accidents

Table 2 Reported death registration completeness (%) by age, sex and province, Nepal, CRVS survey, 2013/14-2015/16

Province	Sex	Age group (years)				
		0–14	15–44	45–64	65–74	75+
Koshi	Male	22.4	74.4	90.8	80.4	83.6
	Female	33.0**	68.6**	62.9**	68.5**	71.8**
	Both sexes	26.7	72.0	79.7	74.6	78.4
Madhesh	Male	15.1	54.0	72.4	70.0	63.9
	Female	4.5**	21.8**	44.5**	58.5**	61.3**
	Both sexes	12.0	39.0	55.4	65.1	62.9
Bagmati	Male	45.0	83.4	91.8	87.4	89.3
	Female	70.4**	69.4**	83.1**	79.3**	78.3**
	Both sexes	57.2	76.5	88.1	83.9	84.3
Gandaki	Male	34.5	89.8	90.3	92.2	87.6
	Female	0.0**	83.5**	66.8**	68.9**	76.4**
	Both sexes	28.4	87.4	79.5	81.1	83.0
Lumbini	Male	14.3	75.3	87.2	87.8	86.2
	Female	8.4**	47.7**	53.8**	72.2**	64.1**
	Both sexes	11.1	64.9	74.7	81.4	77.0
Karnali	Male	14.7	82.4	81.7	78.6	78.8
	Female	4.0**	37.6**	41.9**	52.3**	47.7**
	Both sexes	11.0	66.7	68.9	67.8	66.5
Sudurpashchim	Male	16.4	70.3	86.4	84.8	80.7
	Female	15.2**	24.3**	45.8**	54.1**	64.7**
	Both sexes	16.1	47.9	71.2	70.0	73.1

N (Unweighted) = 4,532 N (weighted) = 3,06,072

**p- value < 0.01, * p-value < 0.05

If the p-value is < 0.05 the association is considered statistically significant

Statistical significance is assessed between male and female completeness for an age group within a province

(OR = 1.947, 95% CI 1.280–2.962), suicide (OR = 1.769, 95% CI 1.081–2.894) and natural disaster (OR = 2.631,95% CI 1.817–3.808) predicted greater odds.

Household heads in armed force, administrative and technical works occupations (OR = 1.563, 95% CI 1.045–2.338) were found to predict death registration compared to skilled workers in agriculture, forestry and fishing, while heads with either no work or students (OR = 0.656, 95% CI 0.469–0.917) had lower odds of a death being registered. Considering ethnicity, where the household head was Hill Adibasi/ Janjati groups and Madeshi (Terai caste), the odds of a death being registered was lower (OR = 0.788, 95% CI 0.648–0.959) compared to the reference group of Caste Origin: Hill Groups/ Khas_Aryan. Secondary and higher education of the household head predicted greater odds of death registration compared with an illiterate household head (higher education OR = 1.962, 95% CI 1.210–3.183). A greater number of communication facilities in a household significantly predicted higher odds of death registration (OR = 1.103, 95% CI 1.017–1.196). House construction was not statistically significant. The odds of death registration was higher if the household head was 65 years and over compared with age 10–18 years (OR = 3.978, 95% CI 1.598–9.902), while household head's sex was not significantly significant. The stepwise analysis

Table 3 Logistic regression results of reported death registration status, all variables, Nepal, CRVS survey, 2013/14-2015/16

Categories / Variables	Odds ratio	95% CI	Categories / Variables	Odds ratio	95% CI
Sex of deceased			Household head's age		
Male (Ref.)	1		10–18 years (Ref.)	1	
Female	0.375**	0.321, 0.437	19–34 years	2.683*	1.100, 6.547
Deceased's age group			35–44 years	2.895*	1.187, 7.061
0–14 years (Ref.)	1		45–54 years	2.793*	1.141, 6.836
15–44 years	6.106**	4.348, 8.575	55–64 years	3.118*	1.268, 7.670
45–64 years	11.367**	8.204, 15.751	65 + years	3.978**	1.598, 9.902
65–74 years	12.193**	8.730, 17.031	**Household head's sex**		
75 + years	10.677**	7.646, 14.910	Male (Ref.)	1	
Province			Female	1.518**	1.252, 1.842
Koshi (Ref.)	1		**Household head's occupation**		
Madhesh	0.585**	0.441, 0.777	Skilled workers in agriculture, forestry, and fishing (Ref.)	1	
Bagmati	1.542**	1.141, 2.083	Armed force, admin, and technical works	1.563*	1.045, 2.338
Gandaki	1.165	0.842, 1.611	Business, service, and factory workers	0.905	0.744, 1.100
Lumbini	0.829	0.632, 1.088	Household work	0.957	0.778, 1.177
Karnali	0.507**	0.368, 0.698	Student and have no work	0.656*	0.469, 0.917
Sudurpashchim	0.548**	0.405, 0.742	**Broad caste/ethnic groups**		
Urban/ Rural			Caste Origin: Hill Groups (Khas_Aryan) (Ref.)	1	
Urban (Ref.)	1		Hill Adibasi/Janajati groups	0.788	0.648, 0.959
Rural	0.971	0.822, 1.146	Newars	0.873	0.647, 1.177
Cause of death			Madeshi (Terai Caste)	0.563	0.436, 0.727
Disease (Ref.)	1		Other	0.470	0.143, 1.547
Pregnancy / childbirth / unable to give birth	0.276**	0.109, 0.697	**House construction**		
Malnutrition	1.010	0.498,2.050	Mud House (soil / bamboo / tile / slate/ jhingati) (Ref.)	1	
Accidents	1.947**	1.280,2.962	Cement bonded bricks house (brick / stone / zinc / tin)	1.055	0.879, 1.265

Table 3 (continued)

Categories / Variables	Odds ratio	95% CI	Categories / Variables	Odds ratio	95% CI
Suicide	1.769*	1.081, 2.894	Cement / Concrete	1.010	0.800, 1.275
Natural disaster	2.631**	1.817, 3.808	Mixed (Cement / Mud/ Concrete)	1.257	0.683, 2.315
Unknown	0.856	0.664, 1.104	**Total communication facilities in household**	1.103	1.017, 1.196
Other	1.252	0.929, 1.687	**Constant**	0.125	0.046, 0.343
Place of death			Statistical significance (p-value): * less than 0.05, ** less than 0.01. $n=4{,}532$ (4,320 household clusters). Ref.: Reference category. Std. Err.: Standard error. CI: Confidence interval.		
House (Ref.)	1				
Health facility	1.074	0.890, 1.295			
Abroad	0.814	0.470, 1.412			
Other	0.897	0.579, 1.390			
Household head's educational attainment					
Illiterate (Ref.)	1				
Primary	1.008	0.786, 1.294			
Secondary	1.539**	1.220, 1.941			
Higher education	1.962**	1.210, 3.183			
Other academic degree and literate (including informal education)	0.944	0.747, 1.193			

in Supplementary Tables 4 and 5 show that the odds ratios of the demographic, geographic and characteristic of death variables change very slightly after inclusion of the socio-economic variables. There is also only small difference between the odds ratios in the regression of age less than 65 years and 65 years and above (Supplementary Tables 6 and 7), with the main changes being in the statistical significance due a smaller number of cases. The only major difference was that, for ages less than 65 years, Lumbini province predicted lower odds of a death being registered (OR = 0.621, 95% CI 0.416–0.926) compared with Koshi.

Reasons for registration and non-registration

The main reasons for death registration and non-registration are presented in Table 4 and by different demographic, socio-economic, and geographical categories in Supplementary Tables 8 and 9. The most prominent reason for death registration is to transfer home / land / property ownership (29%), for social security allowance and to access public services (25%) and for other legal processes (31%), which comprise a combined 85% of reported registered deaths. The next most reported common factors include knowing timely registration is free, convenience/proximity and the influence of public awareness programs via the media or service providers (all less than 10%). Death registration for social security allowance and accessing public services was a much more prominent reason for male (34%) than female deaths (9%). Home/land/property transfer was a similarly common reason for male and female deaths while other legal processes was higher for female (41%) than male deaths (24%). Geo-

Table 4 Reasons for death registration and non-registration by sex (% of registered/non-registered deaths), Nepal, CRVS survey, 2013/14-2015/16

Reasons for death registration (n=3,155)	Both sexes	Male	Female	Reasons for non-registration (n=1,377)	Both sexes	Male	Female
To transfer home / land / property ownership	29.0	28.2	30.4	Because it is a cumbersome process	5.2	4.4	5.8
For social security allowance and access public service	24.9	34.4	8.9	Because there is no need	71.9	70.9	72.7
For other legal processes	30.7	24.3	41.4	Because you have to pay more	0.3	0.4	0.3
Knowing timely (within 35 days) registration is free	9.1	7.9	11.1	Due to lack of required documents (citizenship, recommendation etc.)	4.1	4.4	3.8
Due to convenient registration process	1.8	1.4	2.5	The office of the local registrar is far away	2.6	2.3	2.8
Due to the proximity of the place of registration	0.8	0.6	1.0	As the local registrar could not be found	1.1	1.0	1.2
As it has been informed in the media that registration should be done	0.4	0.3	0.6	No information to register	4.6	5.1	4.2
VDC secretary / local registrar advised	0.4	0.4	0.5	There is no information that registration can be done even after 35 days	0.6	0.2	0.9
Advised by neighbour	1.1	1.0	1.4	Since the registration could be done any time	6.0	6.1	5.9
Other	1.9	1.6	2.2	Other	3.5	5.2	2.3

graphically, in Mountain and Hill ecological belts the most common reason deaths were registered was due to other legal provisions, whereas in Terai the major reason was for transferring property entitlement and legal ownership. Provincially, in Madhesh, Gandaki and Lumbini the most common reason that deaths were registered was for property transfer, whereas in Koshi and Bagmati, the most common reason was due to other legal provisions, and in Karnali and Sudurpashchim the most common reason was for getting access to social security and other public services. Another notable variation was that access to social security and public services was less likely a reason in households with a higher number of communication facilities.

The most common reason behind non-registration of deaths was that there was reported as there being no need to register the death (72%). This reason was the most common across all groups. By province, it ranged between 49% in Gandaki to 85% in Lumbini. Other reasons for deaths not being registered were the cumbersome registration process (5%) and a flexible provision to register death any time (6%). The least common reasons for non-registration were the registration charge and a lack of knowledge about possible registration after deadline of 35 days. Other less reported reasons for non-registration were the registry office being far away and not being able to find a registrar.

The possible interventions for enhancing the quality and coverage of civil registration are presented in Table 5. Among household respondents, 71% said registration would be made more convenient by arranging mobile teams for registration purposes.

Table 5 Household and service provider responses to civil registration questions, Nepal, CRVS survey, 2013/14-2015/16

Household respondents		Service provider respondents			
Ways to make civil registration more convenient	% [a] (n=24,602)	Service delivery options to make event registration effective	% [a] (n=337)	Why people do not register personal events	% [a] (n=337)
By promoting online registration	28.3	Registering from the place of occurrence	27.9	Since it is not necessary	70.0
By arranging a mobile team to register in the ward	71.1	Making mobile registration teams	42.4	As there is no information to register	13.9
By registering at the place of occurrence	37.0	Promoting online registration system	51.6	The registration process is cumbersome	3.6
By assigning civil registration authority to officials other than VDC Secretary/ municipal ward secretary	34.1	By providing some incentives to service providers or service recipients for timely registration	50.7	The office of the local registrar is far away	5.3
Other	4.1	Other	2.1	Because it could be registered any time	62.9
				Because the registration certificate itself cannot be corrected after registration	8.0
				Having to pay a fine	1.2
				Other	5.0

a. *Total adds to more than 100% because more than one option could be selected.*
Each question refers to births, marriages and divorces, as well as deaths.

Other options reported were to make registration possible at the place of occurrence (37%), assigning civil registration authority to dedicated officials (34%) and promoting online registration (28%). Among service providers, 52% suggested that service delivery could be improved by promoting online registration, followed by making provision for certain incentives for both service providers and clients for timely registration (51%), using mobile registration teams (42%), and enabling registration from the place of occurrence (28%). Like household respondents, the major reason for non-registration reported by service providers was that it is not necessary (70%), while the second most common reason was because events could be registered any time (63%). Less common reasons for non-registration included lack of information (14%), that the registration certificate cannot be corrected (8%), cumbersome registration processes (4%), and having to pay a fine (1%).

Discussion

This study has utilized evidence from a nationally representative CRVS Survey to show large differences in the odds of death registration according to certain characteristics of the death, the deceased and their household. Death registration was less likely for females than males, a similar finding to the nearby countries India and Bangladesh, but notably which is not found in most other countries (Adair et al., 2021; Basu & Adair, 2021; Haider et al., 2021). Deaths of children were less likely to be registered than at older ages, while deaths from maternal deaths were also less likely to be registered and those due to external causes (accidents/suicide/natural disaster) more likely to be registered than diseases. Provincially, the study confirms previous findings that registration is least likely in Madhesh, Karnali and Sudurpashchim, and most likely in Koshi, Bagmati and Gandaki (Pandey & Adair, 2022). In Madhesh, Karnali and Sudurpashchim, reasons for lower completeness are lack of awareness of registration and less access to media, lower literacy rates, and high poverty levels compared with other provinces (Ministry of Health - MOH/Nepal, New ERA/Nepal, & ICF, 2017; National Planning Commission, 2018).

The analysis found no difference in the odds of death registration between urban and rural areas nor the place of death. This contrasts with a study in India (Saikia et al., 2023) that found higher death registration completeness in urban areas than rural areas. Similarly, a study in Bangladesh also found higher birth and death registration in urban areas and concluded that this was due to the availability of better health services family planning outreach programs in urban areas (United Nations Children's Fund (UNICEF), 2023). A possible reason behind the lower urban-rural completeness difference in Nepal is the political decision-based demarcation of rural urban areas in Nepal and rapid conversion of rural areas to urban areas over the last decade; urban areas increased from 23% in 2014 to 66% (Bhattarai et al., 2023) in 2017 and the urban population rose from 17% in 2011 to 66% in 2021 (National Statistics Office, 2021). During this period, many newly converted urban areas are still coping with pre-existing problems, including lack of development, geographical remoteness, lack of awareness, lack of accessibility and inadequate physical infrastructure and trained and dedicated human resources (Pandey & Adair, 2023).

Socio-economically, death registration was more likely in households with higher education attainment, where the head works in more technical occupations and where there are more communication facilities. These results correspond with a study done in South Africa in 2016, which also found significant gap in completeness by socio-economic status (Garenne, 2016). An assessment of CRVS system improvement also identified similar socio-economic and geographical differentials of death registration in Myanmar. For instance, death registration was found more likely for males, those of higher education attainment and older age, while being less likely for rural areas, disadvantaged groups and poor households (Tin Oung et al., 2017). By ethnicity, death registration completeness was highest for Newar (who have relatively low poverty) and lowest for Madhesi (who have relatively high poverty); previous analysis has revealed wide gaps in socio-economic status between ethnic groups in Nepal (Central Bureau of Statistics, 2011; Patel, 2012). Additionally, Newar reside dominantly in Bagmati, where completeness is higher than Madhesh, where the Madheshi com-

munity predominantly resides (Pandey & Adair, 2022). For these population groups with low completeness, the utility of mortality data produced by the CRVS system to inform policy is limited (Adair & Lopez, 2021). The inclusion of socio-economic variables in the regression only slightly changed the odds ratios of demographic, geographic and characteristics of death variables, suggesting that socio-economic status influences death registration independently of those factors.

The three main reasons why families register deaths are to transfer land/property, for social security purposes and for other legal processes. The first two of these reasons are legal/administrative processes that require a death certificate, which helps explain higher odds of registration of male deaths because traditionally property has been primarily owned by males and because widow pensions after a husband's death are common. Similar findings have been shown in India to explain the gender gap in death registration (Gupta et al., 2016). These reasons also potentially explain why registration is less likely among children, maternal deaths and in lower socio-economic groups and provinces where land ownership and social security are less common. 'Other legal processes' is less well-defined and is likely where respondents interpret this category as where the death was registered to follow the civil registration law; this may be higher for female deaths because these are less likely than male deaths to be registered for the other legal purposes. Another reason for low registration of child deaths is that for neonatal deaths, which comprise a high proportion of under-five deaths, the birth is often not registered and the death is not registered because families do not feel the need to perform the latter task if the former did not occur (Kasasa, 2021). In hospitals, where a significant proportion of child deaths occur, there is no direct link with the CRVS system, and given that authorized notifiers of deaths can only be family members means that there are no other mechanisms to increase child death registration outside of initial notification by the family (Adair, 2021).

The low importance of proximity to registration offices as a reason for death registration, as reported by both households and service providers, explains why urban/rural differences in the odds of death registration are minimal. A major proportion of our study participants did not perceive death registration important and did not report death within given time period; this is constant across all groups and signifies the persistence of registration only occurring when the family want it to, irrespective of the legal time frame. This reflects that death registration in Nepal primarily only occurs when the family needs it for administrative or legal purposes, as also found in Bangladesh, and the lack of a significant penalty for late registration (Haider et al., 2021). The greater odds of external deaths being registered may be due to additional legal requirements for deaths from these causes and because they disproportionately occur among males of adult ages for whom death registration is required to access specific benefits (e.g. social security). This is not due to police having different reporting processes because they do not report deaths into the CRVS system. The fact that the family is the authorized notifier is demonstrated by place of death (home, hospital, other) not influencing likelihood of completeness.

To increase death registration completeness in Nepal, the CRVS system needs to facilitate easier registration of deaths so that legal and administrative functions are no longer the primary reasons for registration. It is equally important to sensitise people about the policy importance of timely death registration as evidence to imple-

ment heath programs and monitor their progress to minimise premature deaths and targeting specific causes of deaths. For this, accurate and more detailed information about deceased, including age and cause-specific death data for forming better health policies is equally important.(Adair et al., 2021a; Makinde et al., 2020; Saikia et al., 2009)The results of this survey from the perspectives of both households and service providers' show that making registration more convenient, online registration, registration at the place of occurrence, use of mobile teams (although less so according to service providers) and other dedicated agents to register deaths are important. Presently, the online system is operating in 75% of all wards in Nepal. The online system can reduce some of the barriers to non-registration by making registration less onerous for families because deaths can be notified online from home via computer or mobile phone rather than in person. This contributes in reducing the number of people saying death registration is not important, especially in remote areas, and also reduces the burden of local registration offices and DONIDCR by removing paperwork. However, the completeness of the online registration system in 2019 which shows it was lowest in Madhesh, Sudurpaschim, and Karnali, the provinces that the regression results show have the lowest odds of having a death registered when compared with Koshi (Table 4) (Pandey & Adair, 2022). Hence, the roll-out of the online registration system may not have reduced the provincial-level differentials in registration completeness shown in the CRVS Survey. However, the online mode of registration has facilitated real time death registration, reduces workload and time, provides adequate storage of record and enables fast transmission of local level data to a higher level authority. The online system will also enable reporting of more detailed information about the diseased, including age, place and cause of death.

In addition to the interventions mentioned above, use of a more active system to notify deaths using government agents can also be beneficial to increase completeness, as found in Bangladesh where community health workers use routine household visits and regular immunisation services to identify deaths that occur in each local area and help relatives register deaths (Adair et al., 2020). A similar process of death reporting with cause of death also exists in India where health workers or part-time enumerators routinely report deaths the medical officers and trained Sample Registration System supervisors to enable the conduct of verbal autopsies (Krishnan et al., 2020; Nichols et al., 2019). An effective way to improve completeness would be to target interventions in Karnali, Madhesh and Sudurpashchim where it is low. Additionally, other approaches to improve death registration completeness are specific programs encouraging female and early age death registrations, launching of more comprehensive sensitization programs, enabling registering from place of occurrence, making legislations stricter to discourage late registration and provisions for certain incentives for timely registration, deploying dedicated and trained CRVS staff, and making registration compulsory for accessing a wider range of services.

There are some limitations of this study. Firstly, many of the findings are based on deaths that are reported by households in the CRVS Survey. If the information on registration of deaths not reported in the survey are different to those reported in the survey, then it would bias this study's results. However, the strong correlation of sex- and year-specific registration completeness from the survey and the actual registration system by province and ecological belt suggests that such differences are

not major. The service provider questionnaire was only administered in Hill and Terai ecological belts and hence the data were not nationally representative. Also, the service provider questionnaire, unlike the household questionnaire, was administrated to collect information regarding the overall national CRVS system and comprised all vital events, not just deaths. The cause of death data are somewhat lacking in utility given they are reported by households and are not directly from a medical certificate of cause of death. Finally, the results for some causes of death may be under-reported by there being sensitivities to report them due to social, emotional or legal reasons, such as early age mortality, deaths due to suicide, HIV/AIDS or violence.

Despite several recent initiatives to promote death registration in Nepal, completeness remains about 70% and there is substantial variation by demographic, geographic and socio-economic characteristics. The CRVS Survey is the first nationally representative data collection in any country, to our knowledge, of both households and service providers regarding the reasons behind event registration and non- registration, and possible ways to enhance CRVS coverage and quality and to make registration more convenient for families. The barriers and enablers identified in this study are valuable evidence to inform CRVS strengthening efforts in other LMICs facing similar challenges with their death registration system (Abouzahr et al., 2012).

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