Journal of Health Informatics in Africa

Official Journal of the Pan African Health Informatics Association (HELINA)
published by Koegni-eHealth Innovation for Development
HELINA is the Africa Region of the International Medical Informatics Association (IMIA)

Volume 3 (2015) Issue 2

Eds: Dalenca Pottas, Frank Verbeke, Nicky Mostert-Phipps, Ghislain Kouematchoua, Ulrich Kemloh

ISSN: 2197-6902
ISBN: 978-3-9816261-4-8
DOI: 10.12856/JHIA-2015-v3-i2

JHIA : www.jhia-online.org
HELINA : www.helina-online.org
IMIA : www.imia-medinfo.org

Published in the Journal of Health Informatics in Africa
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ISSN/NLM abbreviation: J Health Inform Afr

Publisher
Koegni eHealth, Innovation for Development e.V. Germany
D-22071 Hamburg
Germany
www.koeghi-ehealth.org
E-mail: info@koegni-ehealth.org

Editorial to JHIA Vol 3 (2015) Issue 2

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The Journal of Health Informatics in Africa solicits scientific papers focusing on the use of information and ICTs in the healthcare sector in the broad sense (including self-help, health promotion, education and training of health providers, research, etc.) in Africa.

This second issue of volume 3 (2015) of JHIA is an open-call issue containing three full papers subjected to double-blind peer review. All three papers report on scientific research of interest to and applicable in Africa.

The topics dealt with in the papers are varied yet common in striving to build on and improve capacity in resource constrained settings, whether for health care practitioners, healthcare institutions or within communities. The matters addressed in these papers remain topical for health informatics in Africa.
Submissions to JHIA can be in English or French. The first of the papers in this issue is published in French with the second and third papers published in English.

This issue then concludes volume 3 of JHIA, based on the current publication frequency of two issues within a volume (calendar year). Nicky Mostert-Phipps will be the editor-in-charge for volume 4 (2016) issue 1.

With thanks to the editorial team.

Dalenca Pottas 30.12.2016

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Full Papers

Journal of Health Informatics in Africa

Réseau de Télé-enseignement Médical, Identification des Barrières Technologiques, Organisationnelles, et Humaines

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Background and Purpose: The aim of this research is to find out if by putting in place a new platform accordingly to local conditions of the developing countries and by eliminating the technical obstacles could uncover other organizational and human.
Methods: This study is being done for the RAFT project and involves users of the distance learning systems. It focusses on two distinct series of questions.
Results: The findings have clearly shown that the network can have a great and positive impact on the African healthcare system by creating an access to a continuous medical training and virtually networking medical centers that are otherwise geographically isolated and difficult to access.
Conclusions: At the end of this study the human and organizational barriers often considered as technical issues by the users have been identified as the main reasons of the under-usage of the network. Further research would be needed to evaluate the new system and solve the issues discovered in this study.

Keywords: tele-education, telemedicine, continuing medical education, organizational and human factor, ICT.

1 Introduction

Cette étude a pour but d'analyser et d'identifier, à partir d'une expérience d'utilisation d'un réseau de télé-enseignement, les facteurs constituant des barrières au bon fonctionnement d'un tel réseau pour les utilisateurs. Il nous semble important d'évoquer brièvement quelques grands intérêts de ce type de réseau, initié dans le but d'aider les pays du Sud où la déficience du système sanitaire reste importante. Il s'agit notamment de : la formation médicale continue, les téléconsultations et télé - expertises, la création du contenu médical.

La concentration de la presque totalité des spécialistes dans les capitales semblent un facteur déterminant dans le déséquilibre du système sanitaire de ces pays. Les nouvelles technologies de l'information et de la communication (NTIC) ont prouvé leur efficacité comme argument pour le recrutement et le maintient des professionnels de la santé dans les zones rurales ou géographiquement éloignées [1, 2]. Demeure, encore la question du choix des technologies à adopter en fonction du contexte et l'identification de leurs barrières potentielles.

Pour revenir au contexte de notre étude, il y a cinq ans le service d'informatique médicale de Genève en collaboration avec les pays du Sud a initié un projet appelé le Réseau en Afrique Francophone pour la Télémédecine (RAFT) [3]. La technologie utilisée a été mise en place par l'université de Genève, afin de répondre à la contrainte des faibles bandes passantes. Malgré son adéquation technologique, ce système est sous-utilisé. Notre étude se propose donc d'étudier les facteurs en cause. Nous avons opté pour une étude focalisée sur les utilisateurs, afin d'identifier les facteurs technologiques ainsi que les moyens de les surmonter, et de vérifier s'il n'y a pas d'autres facteurs résiduels tels que humains et organisationnels [4, 5] ou simplement une résistance aux systèmes informatiques bien connus dans le domaine médical [6].

La Formation Médicale Continue (FMC) dont l'histoire remonte à la ville de Venise en l'an 1300 où la certification de spécialiste donnait le droit initial d'exercer la médecine, a été introduite dans la médecine

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 J Health Inform Afr. 2015;3(2):1-14 10.12856/JHIA-2015-v3-i2-132

occidentale depuis très longtemps. Exigée aux USA depuis une trentaine d'années, elle reste encore facultative dans les pays en développement faute de moyens [7]. Elle est devenue obligatoire dans certaines régions de la France depuis 2002[8], même si son influence sur la pratique médicale est encore discutée [9]. Elle est de plus en plus facilitée par la mise en place de réseaux sociaux et de recherche pour les professionnels de la santé [10].

Depuis une dizaine d'années avec l'avènement des NTIC de nouveaux besoins ont émergés en matière d'enseignement et de formation [11]. Le téléenseignement, de par la diversité de ses implications, constitue l'un de ces principaux besoins. Ces nouveaux enjeux concernent tous les domaines : enseignement initial et universitaire, organismes de formation professionnelle, les entreprises et même les particuliers. Actuellement, on parle de plus en plus d'universités agéographiques, virtuelles et d'universités numériques pouvant prendre un caractère, sous-régional, national et même mondial [12].

Les récents progrès des technologies de l'information ont eu des effets positifs sur la santé publique à travers la télémédecine : téléconsultation, réseaux pour les maladies infectieuses, réseaux sous-régionaux de santé publique, réseaux sanitaires interactifs, réseaux de surveillance des maladies, développement de ressources humaines et formations permanentes, et surtout la formation professionnelle et continue à distance par le biais du téléenseignement. Les technologies évoluent très rapidement, souvent sans analyse préalable des besoins des utilisateurs, en particulier, pour les pays du Sud, qui outre les problèmes organisationnels doivent pouvoir bénéficier des technologies adaptées à leur contexte. On assiste ainsi à une explosion des plateformes d'enseignement ouvertes et à distance pour le travail d'équipe en général, et de télémédecine en particulier [13, 14, 15, 16]. Elles peuvent être synchrones (visioconférence ou systèmes interactifs) ou asynchrones (forum de discussions, campus numériques).

Deux dispositifs contextuellement, et technologiquement proches de ceux utilisés dans notre étude, méritent d'être cités. Il s'agit de Algora [17] et Virtu@l Consult@tion, mise en place à l'université de Rennes pour les séances d'apprentissage du raisonnement clinique à distance [18].

En France, depuis 1996, la Conférence internationale des Doyens des Facultés de Médecine d'Expression Française (CIDMEF) s'est fixée comme objectif de développer les NTIC pour la formation initiale et, continue dans le domaine de la santé [19]. D'autres projets comme l'UMVF (Universités médicales Virtuelles Francophones), et le CISMEF (Catalogue d'Indexation des Sites Médicaux Francophones) [20], témoignent des efforts consentis par le monde médical dans le but de faciliter la formation médicale au moyen des NTIC.

Au Royaume Uni, une étude récente montre les avantages de l'enseignement à distance dans les soins de santé, mais aussi ses contraintes organisationnelles [21]. En Amérique du Nord plusieurs projets d'enseignement à distance depuis deux décennies ont été initiés dans le cadre de la formation médicale continue à distance [22, 23, 24, 25] :

Un rapport de 1995 du conseil canadien des ministres de l'éducation montre que les prestataires des soins de la santé ont beaucoup recours à la formation à distance (FAD). De 1993 à 1994, le réseau de Télémédecine Canada à l'Université de Toronto, a diffusé par audioconférence plus de 1000 heures de cours d'éducations permanentes, dans 65 disciplines médicales touchant plus de 850 centres médicaux du Canada, et 150 centres aux Etats-Unis[7].

L'Organisation Mondiale de la Santé dans sa politique d'amélioration de la qualité des soins dans les pays en développement, élabore de plus en plus des stratégies de télé-enseignement médical, telle que la mise en réseau des pays du Pacifique occidental [26]. En Afrique du Sud et d'autres pays comme le Zimbabwe, les approches de partenariat pour utiliser l'enseignement à distance au sein des Universités se dessinent de plus en plus [27].

Concernant les technologies de communications utilisées, la technologie satellitaire semble être plus efficace pour une meilleure qualité audio et vidéo, surtout dans les domaines de formation médicale comme la chirurgie [28]. C'est également la plus chère. Notons ici qu'à côté de ces hautes technologies, il existe également des technologies à faible bande passante dont l'efficacité a été démontrée [29, 30].

Quelle que soit la technologie de communication Internet utilisée, la télémédecine semble être un formidable outil pour pallier à l'isolement des centres médicaux difficilement accessibles dans les pays du Sud [31].

Malheureusement certaines études montrent l'existence des barrières à l'utilisation des ces systèmes d'enseignement à distance [31]. Ces barrières peuvent être de tous les ordres : technologiques, humaines, organisationnelles. Dans le même sens les facteurs d'interaction homme - machine ne sont pas négligeables d'une manière générale dans la mise en place des systèmes informatiques en santé [33]. Le

problème le plus difficile à résoudre parmi ces barrières est la notion de résistance au changement, dont font référence plusieurs études notamment celle de Nancy Lorenzi [34]. L'objectif général de notre étude est d'identifier les barrières potentielles à l'utilisation du Réseau de Télé-enseignement. Les objectifs spécifiques sont:

- Vérifier si la mise en place de la nouvelle plateforme Dudal permet de lever les barrières technologiques et accroitre ainsi l'utilisation du réseau de téléenseignement
- Mettre en évidence les barrières humaines, organisationnelles et individuelles

2 Matériels et méthodes

2.1 Les systèmes de téléenseignement

Pour mener notre recherche, l'étude s'est basée sur deux systèmes de télé-enseignement. Le premier système a été, utilisé durant cinq ans et le deuxième a été livré et évalué après une période d'utilisation de trois mois. Il s'agit des plateformes permettant les séances d'enseignement à distance en live. La figure 1 illustre une séance d'enseignement à distance.

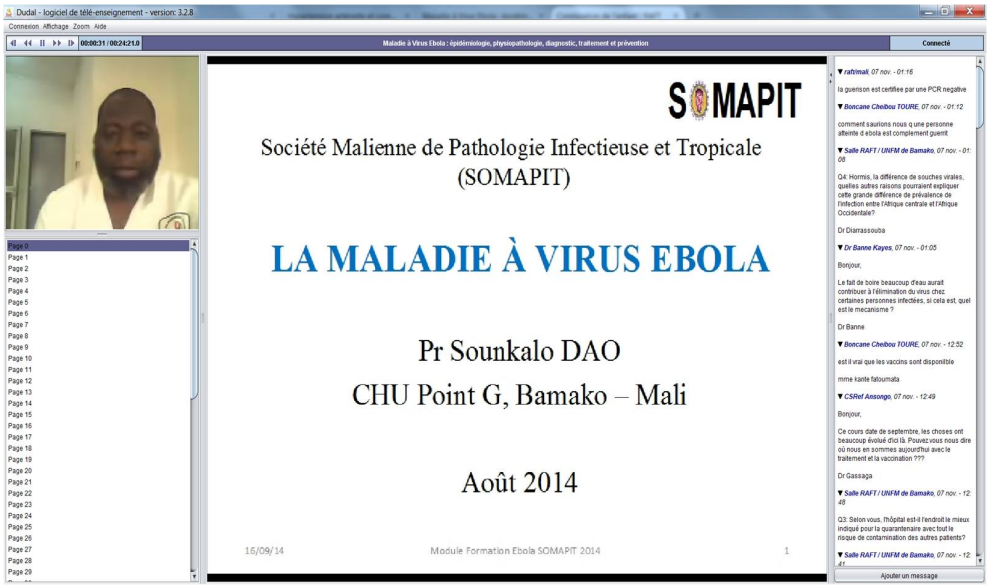

Fig. 1. Illustration d'une séance de télé-enseignement médicale

2.1.1 L'ancien système: « système e-cours »

Mise en place par le département informatique de l'Université de Genève, ce dispositif a pour but de rendre accessible à distance des cours, des séminaires, et des conférences via le web. Ce système ne nécessite aucun logiciel propriétaire particulier à installer côté auditeur. Côté serveur le seul logiciel propriétaire est Real producer®. Il faut noter que le système n'est pas gourmand en bande passante car il fonctionne avec une connexion par modem de 56 Kbits/s (28,8kbits/s sans vidéo).

Ce dispositif qui paraissait pourtant simple a été techniquement lourd à mettre en oeuvre par les utilisateurs des pays du Sud. Cette lourdeur s'expliquerait par les faits suivants : nécessité de compétences techniques pour configurer le système ; la quantité de matériels nécessaires (PC, serveurs, camera) rendant le système difficilement transportable d'un endroit à l'autre pour la diffusion des cours. La modélisation en diagrammes de séquences a été faite avec UMLTM (Unified Modeling Language) [35].

2.1.2 Le nouveau système: « Dudal »

Ce système a été mis en place après la proposition d'une architecture par notre projet de recherche tenant compte des besoins exprimés par les utilisateurs. Il est complètement implémenté en langage Java, ce qui assure au système sa sécurité, sa transportabilité et l'indépendance de la plateforme. L'accès au système

se fait depuis une page Internet ou directement à travers une URL permettant de télécharger le logiciel et de l'exécuter sur la machine locale, de l'utilisateur de manière automatique grâce à la technologie Java Web Start [36]. Les avantages le différenciant du premier système sont sa sécurité face aux coupures intempestives de la connexion Internet dans les pays du Sud, car il fonctionne selon deux modes côté serveur : mode local, et mode relais (serveur distant), sa transportabilité par le nombre réduit de matériels nécessaires (juste un ordinateur portable et une Webcam). Il est en outre adapté aux bas débits avec un encodage du son et d'image au choix et un débit minimum nécessaire de 20Kbits/s. Il n'est plus nécessaire d'utiliser un encodeur propriétaire pour le son, cette tâche est réalisée par la librairie libre Speex [37].

2.2 Les questionnaires

Deux questionnaires ont été préparés :

- Le premier (30 questions), a été élaboré dans le but de recueillir des données sur l'intérêt des utilisateurs pour le réseau, les difficultés organisationnelles et individuelles, les problèmes techniques posés par le système « e-cours », et la fréquence d'utilisation du réseau.
- Le deuxième questionnaire (10 questions) a été envoyé après trois mois d'utilisation du nouveau système pour évaluer brièvement sa convivialité, sa facilité d'utilisation, et son impact sur la fréquence d'utilisation du réseau, c'est-à-dire le nombre de cours produits, et émis localement.

L'élaboration des questions a été faite, selon la méthode de Likert [38]. Les différentes questions, exceptées les questions ouvertes, étaient évaluées selon une échelle de cinq positions, avec comme valeurs extrêmes « Pas du tout d'accord » à « Entièrement d'accord ». Les questions ouvertes étaient évaluées par « oui » ou « non » et devaient être justifiées quelle que soit la réponse.

2.3 Les participants

Il s'agit des coordinateurs locaux pour la production technique des télé-enseignements. Ils sont chargés de coordonner le réseau local, de sensibiliser les experts locaux à produire et émettre des cours, via le système, pour la formation médicale continue pour les pays du Sud, et ceux du Nord au besoin. Ils sont donc chargés d'organiser toute la chaîne de réalisation du télé-enseignement depuis la préparation des cours sous forme de présentations PowerPoint® (si l'expert sollicité ne sait pas le faire), jusqu'à la mise en ligne du cours et sa diffusion sur le réseau. Au nombre de vingt huit représentants des équipes locales de six pays (Côte d'Ivoire, Mali, Mauritanie, Sénégal, Burkina Faso, Madagascar), ils ont tous pris part à l'étude.

2.4 Méthode d'analyse des résultats

L'analyse a été faite à l'aide du logiciel de statistique BMDP®. Pour la première partie de l'étude les questions ont été analysées individuellement, puis selon les regroupements définis précédemment. Le coefficient de corrélation non-paramétrique de Spearman (ρ) a été calculé entre les différents facteurs. Les participants avaient reçu chacun un numéro de code qu'ils ont reporté sur les deux questionnaires. Ceci a permis d'analyser simultanément les deux questionnaires.

3 Résultats

3.1 Modélisation des deux systèmes sous forme de digramme de séquence UML

Les figures 2 et 3 ci-dessous illustrent les résultats des illustrations des deux systèmes sous forme de diagrammes de séquences UML, montrant ainsi leur différence de complexité dans la réalisation des cours.

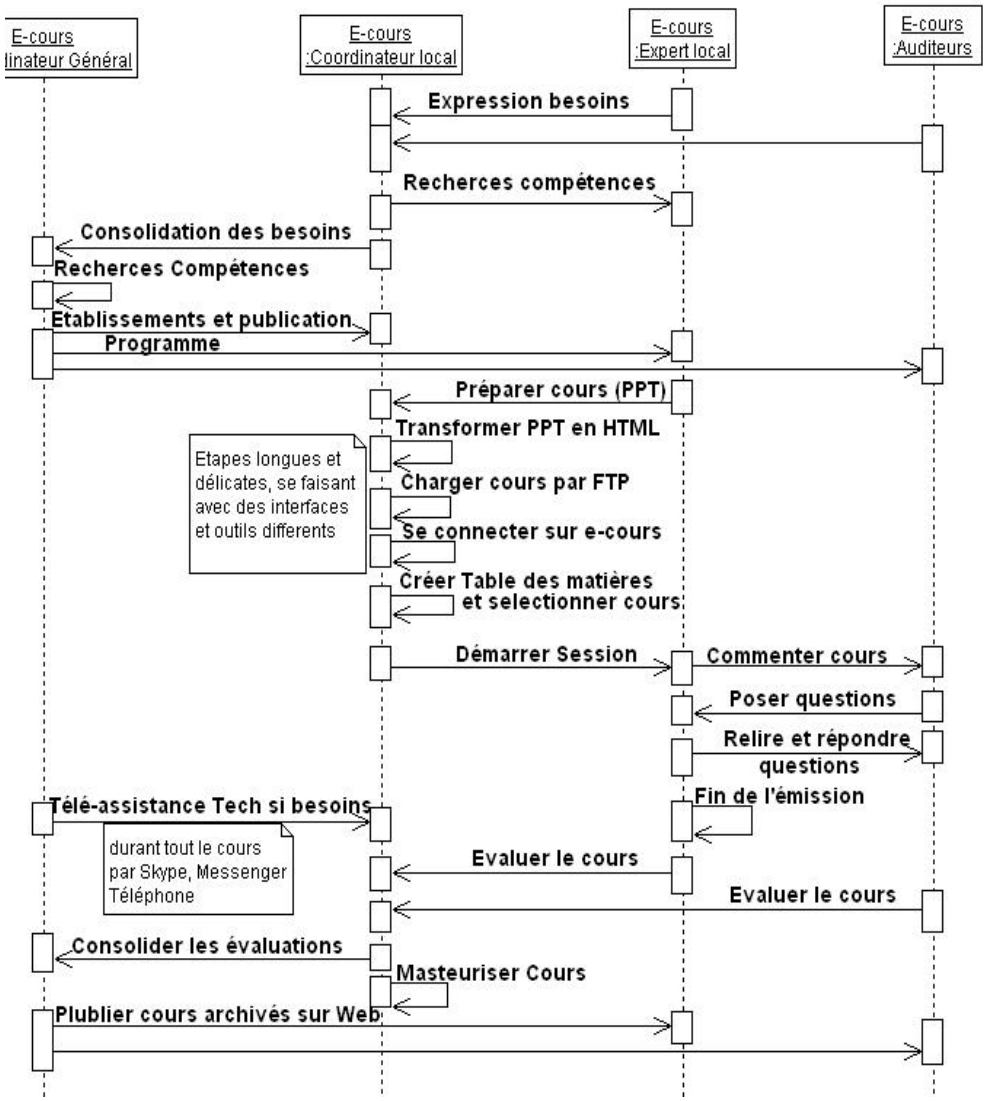

Fig. 2. : Modélisation en séquence UML du système « e-cours »

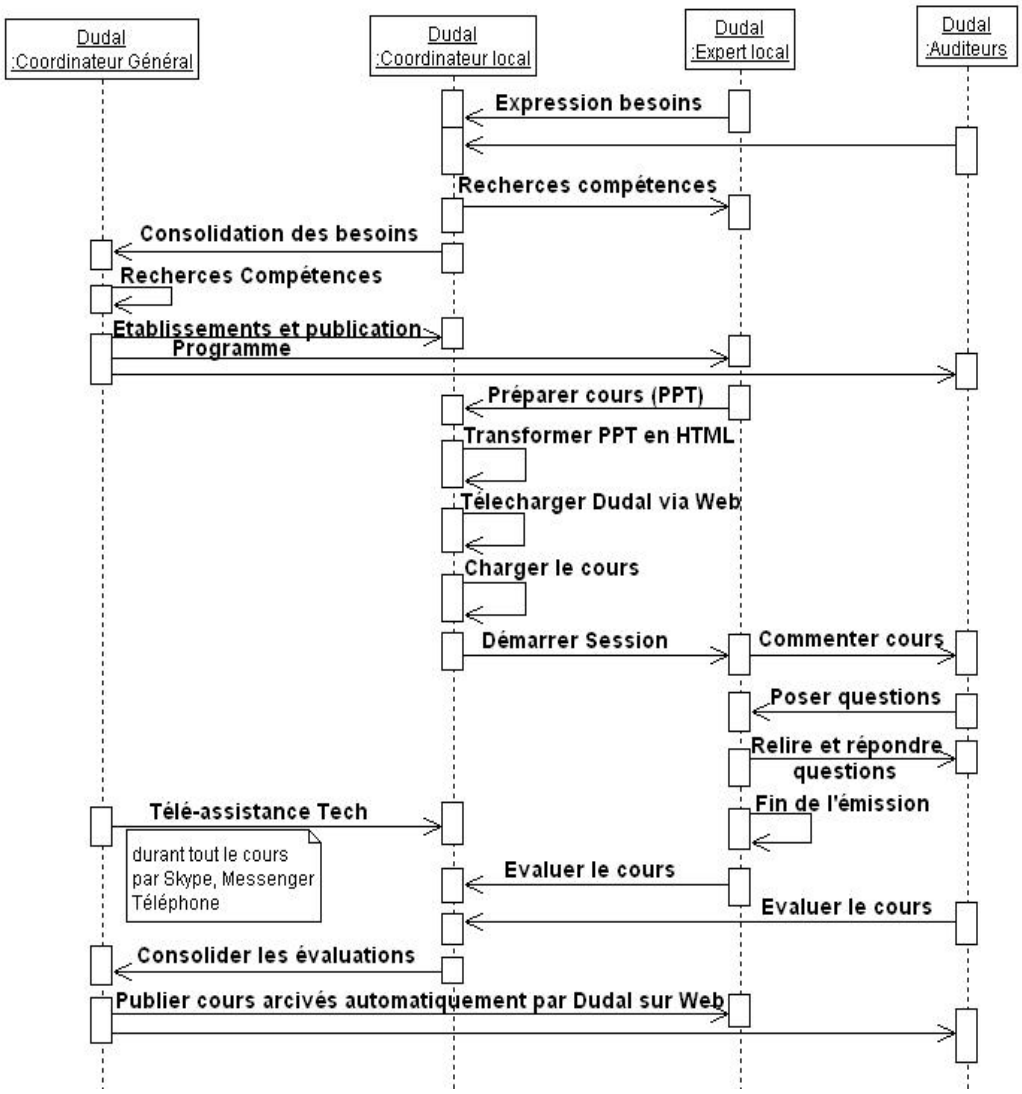

Fig. 3. : Modélisation en séquence UML du système « Dudal »

3.2 Résultats du premier questionnaire

3.2.1 Les problèmes techniques

Sur les 7 questions se rapportant aux problèmes techniques seule une, concernant l'interface du système « e-cours », a rapporté une majorité de satisfaction : 57% des participants qui le trouvent convivial. Les 6 autres questions ont été retenues comme sources de problèmes techniques (figure 1). Ce sont par ordre d'importance :

- La lenteur du réseau de communication ou le débit Internet pose des problèmes pour 71% des utilisateurs, avec 29% qui ont une opinion neutre.
- La disponibilité du système « e-cours », c'est-à-dire l'accès au serveur est mis en cause par 68% des utilisateurs
- La quantité de matériels informatiques nécessaires pour faire fonctionner le système est considérée comme problème par 64% des utilisateurs
- Le manque de transportabilité du système est source de problème pour 61% des utilisateurs
- La nécessité de configurer le réseau de communication et l'autonomie d'électricité limitée sont jugées comme sources de problèmes par 54% des utilisateurs

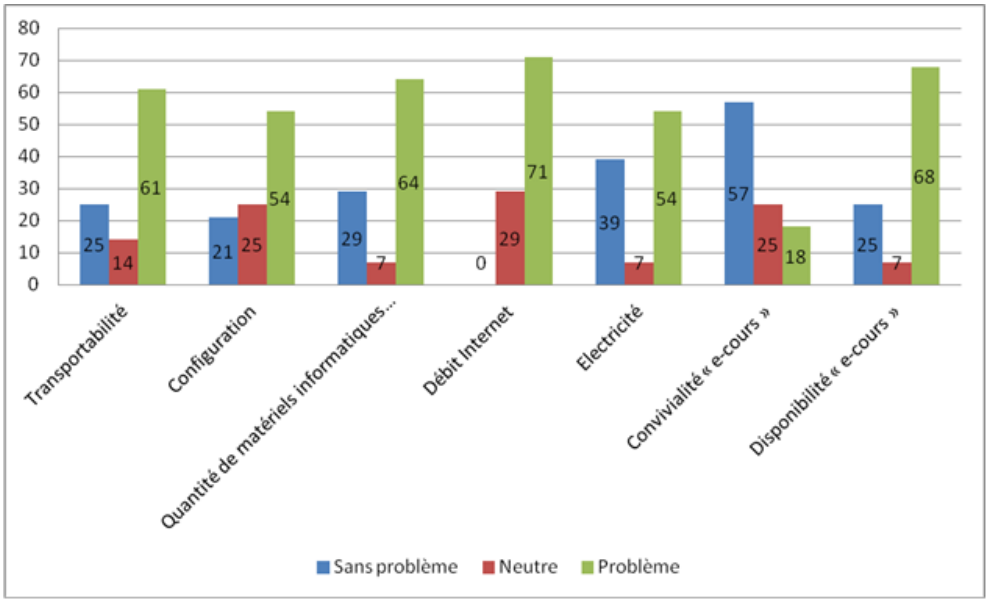

Fig. 4. Avis des participants sur les facteurs techniques en rapport avec la sous utilisation du réseau de télé-enseignement

3 2 2 Les problèmes humains ou individuels

Parmi les 9 questions concernant les causes de dysfonctionnement du réseau seules 4 ont été majoritairement cautionnées par les utilisateurs (figure 2). Il s'agit par ordre d'importance de :

- La faible motivation des experts locaux constitue pour les utilisateurs la cause la plus importante de dysfonctionnement du réseau dans 75% des cas,
- L'attachement des professionnels de la santé aux méthodes traditionnelles de formation serait cause de la faible production de contenus pour les utilisateurs dans 61% des cas
- La non rémunération des producteurs de contenus posait problème pour 53% des utilisateurs
- Les difficultés ou la peur d'utilisation de l'outil informatique seraient à la base de refus des experts de contribuer au réseau pour 43% des utilisateurs

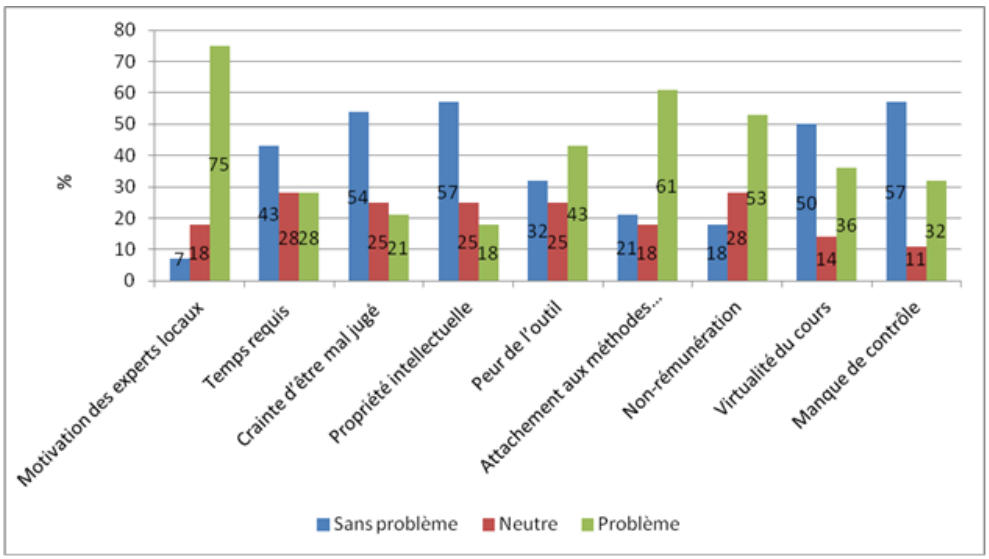

Fig. 5. Avis des participants sur les facteurs humains ou individuels en rappport avec de la sous utilisation du réseau de télé-enseignement

3.2.3 Les problèmes organisationnels

Le manque de soutien institutionnel de la part de l'Université et du ministère de la santé par exemple est une source très importante d'échec du réseau pour 82% des utilisateurs. 75 % des utilisateurs pensent que le manque de soutien politique national, et la nécessité de faire déplacer les experts dans un autre endroit (salle technique du e-cours) pour animer les cours sont sources de dysfonctionnement du réseau. L'absence des champions locaux constitue un facteur défavorable pour la réussite du réseau pour 64% des utilisateurs.

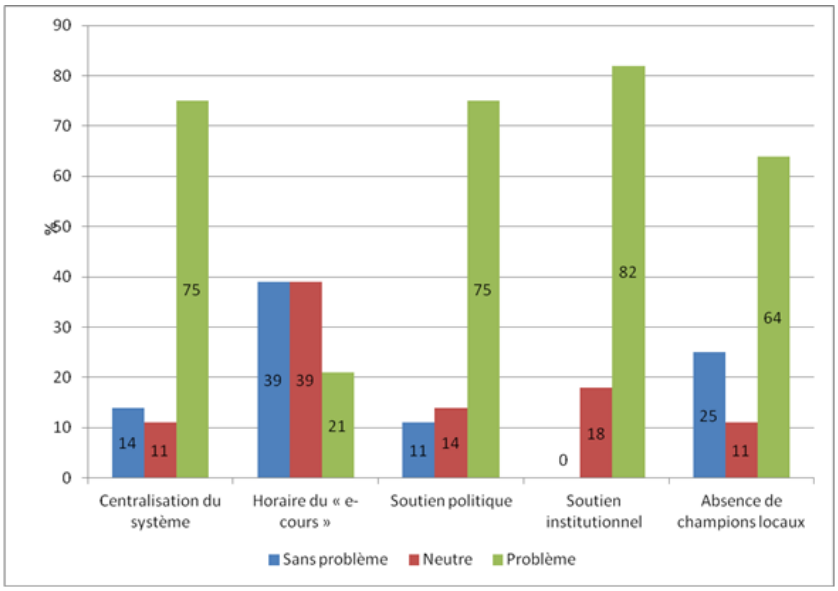

Fig. 6. Avis des participants sur les facteurs organisationnels en rappport avec de la sous utilisation du réseau de télé-enseignement

3.2.4 L'utilité du réseau

Pour la presque totalité des utilisateurs (92%) le réseau de téléenseignement permet de réduire, l'isolement des centres médicaux difficilement accessibles, 64% des utilisateurs pensent que le réseau serait une solution à l'inégalité d'expertise médicale entre les pays du Nord et ceux du Sud, et 54% trouvent qu'il constituera une source de motivation des professionnels de la santé d'aller servir dans les zones rurales et éloignées.

A la question concernant comme prioritaire la formation médicale, tous les utilisateurs ont répondus favorablement. Cette unanimité a aussi été observée quant à la question de savoir, si le téléenseignement médical répond de façon adéquate à cette priorité. 93% des utilisateurs pensent qu'avec une technologie adaptée, le réseau serait une source d'adaptation des contenus aux réalités locales.

Concernant la satisfaction des professionnels sollicités pour donner des cours, 61% des utilisateurs pensent qu'ils n'ont pas la même satisfaction de donner un cours en ligne qu'un cours standard.

Enfin 54% d'utilisateurs pensent, que le réseau permettra de freiner l'exode rural des professionnels de la santé vers les villes urbaines si un système adapté est mis en place.

3.2.5 L'évaluation du réseau

Le réseau a été évalué en fonction de sa fréquence d'utilisation. Il apparaît clairement qu'il était fortement sous-utilisé, 82% des partenaires n'utilisent pas du tout le réseau pour diffuser des cours, 14% l'utilisent irrégulièrement (au plus une fois par mois) et un seul l'utilise régulièrement (2 à 3 cours par mois).

3.2.6 Relation entre les différents facteurs [39]

Pour étudier les relations entre les différents facteurs nous avons calculé les coefficients corrélation de Spearman. Plus cette corrélation s'approche de la valeur 1 pour deux facteurs donnés, plus il y a de lien entre ces deux facteurs.

Les problèmes techniques sont liés avant tout aux problèmes individuels avec un coefficient de corrélation de Spearman ρ à 0.59, et avec les problèmes organisationnels (ρ =0.41) et l'utilité du réseau (ρ=0.39). La sous-utilisation du réseau est liée de façon non significative aux problèmes techniques (ρ = - 0.19) et individuels (ρ = - 0.19).

Le réseau est considéré d'autant plus utile que l'utilisateur a plus de problèmes technologiques (ρ=0.39, ρ<0.05), et de façon non significative aux problèmes organisationnels (ρ=0.18) et individuels (ρ=0.19). Les problèmes technologiques expliquent le 16% du manque d'utilisation du réseau.

Il ressort de cette analyse que les utilisateurs ayant des problèmes technologiques qui sont les plus convaincus de l'utilité du réseau.

3.3 Résultats du deuxième questionnaire

Trois points essentiels ont été testés concernant le nouveau système dans ce questionnaire. Il s'agit des compétences requises des utilisateurs pour le faire fonctionner, l'évaluation de la convivialité et de l'adaptabilité du système, et enfin la fréquence d'utilisation du réseau avec ce nouveau système. Il faut noter ici que sur 28 questionnaires distribués, deux utilisateurs n'ont pas répondu, soit un taux de réponse de 93%.

Concernant les différentes compétences nécessaires pour utiliser le système « Dudal », tous les utilisateurs avaient au minimum une compétence moyenne. Au total, il y a environ un tiers des participants qui disent avoir des compétences moyennes, une petite moitié qui ont des bonnes compétences, et entre 20 et 25% qui se considèrent comme experts, et ceci quelque soit la question considérée (figure 4).

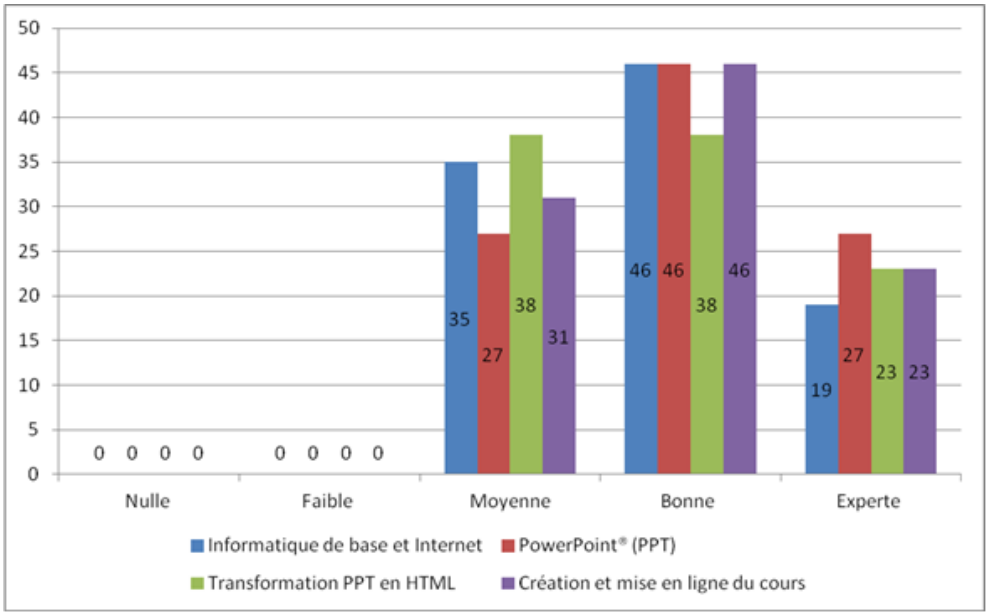

Fig. 7. Evaluation des compétences des utilisateurs pour utiliser "Dudal"

En somme on peut conclure que l'évaluation de «Dudal» est positive, plus de la moitié des participants le juge sans problème, un tiers des participants pensent qu'il n'y a pas de véritable problème, et moins d'un quart sont moins enthousiastes (figure 5).

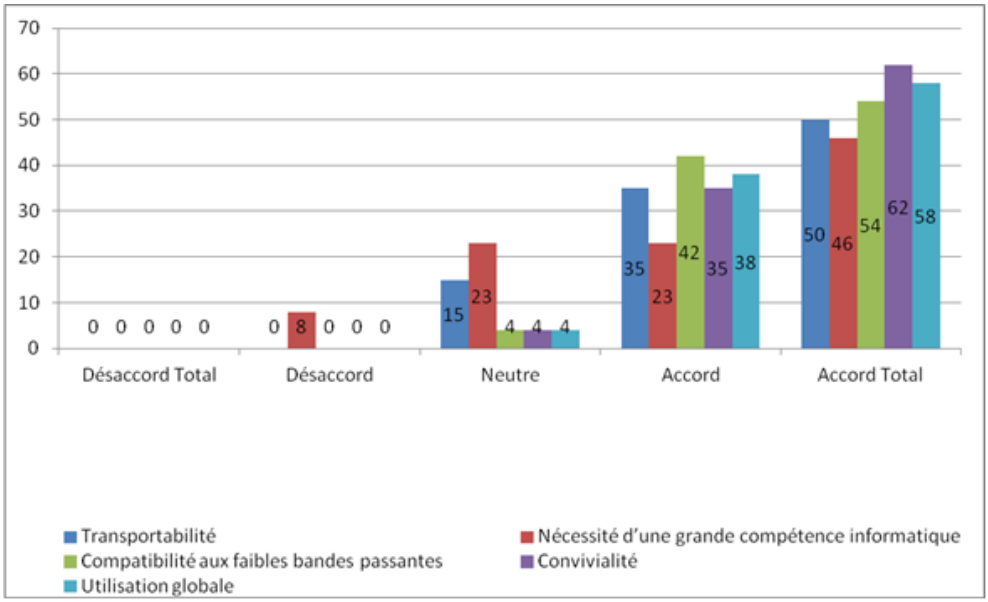

Fig. 8. Evaluation de "Dudal"

Le système malgré son adéquation reste sous utilisé. Plus de trois quarts des participants n'ont pas du tout utilisé le système, il a été moyennement utilisé par deux participants, et 3 participants seulement l'ont utilisé de manière satisfaisante (figure 6).

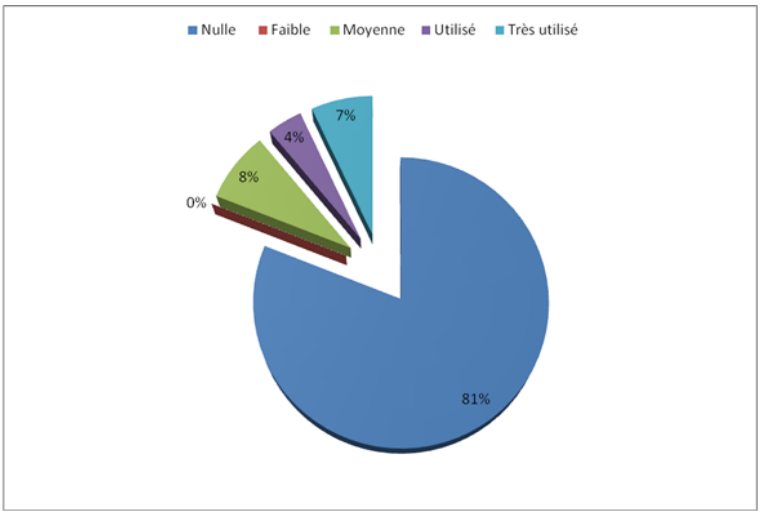

Fig. 9. Utilisation du réseau après la levée des barrières technologiques

4 Discussion

4.1 La méthodologie de la recherche

Concernant notre méthodologie de travail, nous nous sommes basés principalement sur l'expérience d'utilisation d'une première application dans le but de surmonter les difficultés techniques d'utilisation et d'adaptabilité évoquées par ses utilisateurs qui les tenaient pour responsables du dysfonctionnement du réseau. Une nouvelle application a été en place. Elle tenait compte des besoins et contextes des utilisateurs. D'autres approches plus méthodiques, mais nécessitant plus de temps auraient pu être utiles, pour mieux comprendre tous les aspects de l'interface homme-machine [40, 41].

4.2 A propos des résultats de l'étude

S'il est clairement apparu, lors de la première phase de la recherche, que les principales barrières étaient d'ordre technologique, par contre on s'est très vite rendu compte que le fonctionnement du réseau était freiné pour une grande part, par des problèmes organisationnels et humains. Les études statistiques telles que détaillées au niveau des résultats attestent ce fait.

Le résultat insatisfaisant malgré l'élimination des barrières techniques, pourrait s'expliquer par le fait que le temps entre la mise à disposition du nouveau système et son évaluation est court (trois mois). Cette nuance reste discutable dans la mesure où les problèmes techniques qui ont été résolus, étaient les seuls facteurs d'échec évoqués par les utilisateurs au début de l'étude.

Au niveau de l'exhaustivité des facteurs à identifier, si l'étude a pu cibler la presque totalité des problèmes, d'autres non négligeables ont été régulièrement cités comme facteurs influençant le fonctionnement du réseau par les utilisateurs à savoir : l'inexistence des modules informatiques dans le cursus médical, l'absence d'une vulgarisation des TIC (Technologies de l'Information et de la Communication), et de la télémédecine dans le domaine médical, le manque de sensibilisation des décideurs politiques, l'inexistence d'une politique d'obligation de résultats au niveau du réseau, la non implication des jeunes, l'inadaptabilité du contenu aux réalités locales.

Une autre difficulté de notre étude reste la mise en évidence des obstacles liés au changement qui son souvent cachés par des faux enthousiasmes, tels que le démontre l'étude de Nancy Lorenzi [34].

Concernant le nouveau système « Dudal » nous n'avons évalué que les critères ergonomiques c'est-à-dire l'interface homme-machine. Malgré les résultats satisfaisants des utilisateurs, il est encore trop tôt pour tirer des conclusions finales sur sa fiabilité technique après seulement trois mois d'utilisation.

5 Conclusions

Notre recherche s'est inscrite dans un souci de trouver un meilleur modèle de communication interactive, entre les professionnels de la santé pour améliorer la qualité des soins par le partage de connaissances et d'expertises médicales sur une partie de la planète où tout reste prioritaire dans le domaine de la santé; partageant ainsi l'opinion du directeur général de l'Organisation Mondiale de la Santé, lors du forum de haut niveau, à Paris, en novembre 2005 : « Nous devons collaborer pour que chacun, dans tous les villages, partout dans le monde, puisse compter sur un agent de santé motivé, qualifié et bien soutenu» [42]. Sans conteste, les résultats de notre étude prouvent que le réseau de téléenseignement est une des plus importantes réponses à cette préoccupation [2].

Au terme de notre étude un certain nombre de « coupables » ont été identifiés. Il s'agit de :

Sur le plan organisationnel par ordre de priorité :

- Le manque de soutien institutionnel à savoir des facultés de médecine et des ministères de la santé
- La transportabilité physique du dispositif de télé-enseignement
- Le manque de soutien politique au niveau national
- L'absence des champions locaux pour une bonne coordination locale

Sur le plan individuel ou humain par ordre d'importance:

- La faible motivation des experts locaux
- L'attachement des professionnels de la santé aux méthodes traditionnelles de formation médicale continue
- La non-rémunération des producteurs de contenus médicaux
- La peur de l'outil informatique par les professionnels de la santé.

A la lumière de cette recherche nous tirons quelques enseignements qui sont les suivants:

- La connaissance du terrain constitue la clé du succès d'un tel réseau de téléenseignement, car les choix technologiques et humains en dépendent.
- Une attention particulière doit être portée sur les obstacles organisationnels et humains qui sont le plus souvent dilués dans les problèmes techniques.

- Dès qu'une technologie introduit un changement de comportement, quelle que soit sa simplicité, et son intérêt, elle suscite des résistances qui ne sont pas forcement patentes, et très souvent couvertes par de faux enthousiasmes surtout au niveau des décideurs. Il faudrait alors prévenir ces résistances dès le début des projets.
- Le concept de réseau, de part son caractère interactif et multilatéral, est source d'émulation d'une communication interhumaine et constitue à ce titre un grand centre d'intérêt pour les professionnels de la santé.

Enfin une étude complémentaire serait souhaitable dans le but d'évaluer plus correctement le nouveau système mis en place.

Remerciements

Cette étude a été réalisée avec le soutien du Réseau en Afrique Francophone pour la Télémédecine (RAFT).

Conflits d'intérêt

Tous les auteurs déclarent n'avoir aucun conflit d'intérêt.

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Journal of Health Informatics in Africa

The communication channel which generates the most demand for Voluntary Medical Male Circumcision at Ndola Central Hospital.

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Background and Purpose: It has been demonstrated that male circumcision has numerous health benefits. Various channels of communication are used to disseminate information about male circumcision. The objective of this study was to identify the communication channels which generate the most demand for voluntary medical male circumcision (VMMC) at Ndola Central Hospital (NCH).
Methods: All clients aged16 years or older who came for VMMC at NCH in a period of 3 months (01/02/15 to 01/05/15) were captured in the study. A structured questionnaire was used to collect data. Data entry and analysis were conducted using Epi Data version 3.1 and SPSS version 16.0, respectively. The Pearson's Chi-square and the Fisher's exact tests were used to establish associations. The cut off point for statistical significance was set at the 5% level.
Results: A total of 94 individuals participated in this study. Participants who were 16-24 years were motivated by Community leaders (22.3%), Television (22.3%) and Friends (20.2%). The 25+ age group cited Television (18.1%), Radio (18.1%) and Friends (18.1%) as the channels that generated most of their interest for VMMC. Overall, the highest demand to undergo VMMC was generated by Television (40.4%). 66% of participants believed that women are better promoters of VMMC. About 3 in 4 (78%) of the participants had to seek second opinion before undergoing VMMC.
Conclusions: Television as a channel that generated most of the interest for VMMC should be used in order to increase uptake of VMMC.

Keywords: male circumcision, communication strategy, Zambia.

1 Introduction

There is a low level of circumcision in Zambia. Only 13% of men are circumcised.[1] Most (71%) of circumcised men are from North-Western province, 40% from Western Province while all other provinces have 14% or less of circumcised men.[2] Creating demand for VMMC involves several activities aimed at increasing awareness of VMMC among men and women, provide concise information on VMMC benefits, inform and encourage the public where they can access VMMC services as well as to dispel myths from the public.[3] Knowing the best communication channel which would generate the most response is critical in effectively scaling up MC.

It was the aim of this research therefore, to identify the communication channel which generates the most demand for male circumcision at Ndola Central Hospital.

2 Materials and methods

2.1 Study site

The study was conducted at the Male Circumcision clinic of NCH. NCH is a government hospital in Ndola town of the Copperbelt, located along Nkana Road.

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2.2 Study design, sample size and sampling

All clients aged 16 years or older who came for VMMC at NCH in a period of 3 months (01/02/15 to 01/05/15) were captured in the study. A structured questionnaire was used to collect data. Data entry and analysis were conducted using Epi Data version 3.1 and SPSS version 16.0, respectively. The Pearson's Chi-square and the Fisher's exact tests were used to establish associations. The cut off point for statistical significance was set at the 5% level.

2.3 Ethical considerations

The research protocol was approved by the Copperbelt University, Public Health Department. Permission to conduct the study was given by NCH administration. Verbal consent was obtained from each study participant.

2.4 Data collection

A structured questionnaire was used to collect data from the VMMC clients. The questionnaire included questions on age, adequacy of VMMC information the first time it was received, the communication channel which made them decide to have VMMC, and whether women are better promoters of MC than men. Participants were requested to circle/tick the appropriate communication channels in each category: (i)Targeted advocacy: Politicians, Celebrities and Community leaders; (ii) Mass media: Radio, Television, SMS, Newspapers, Magazines and Billboards; (iii) Mid-Media: Public announcements using loud speakers, Speeches, Special promotion events, Posters and Drama group presentations; (iv) Interpersonal Relationships: Parents, Spouse, Girlfriend, Friends, Workmates and Counseling; (v) Other: here, participants were required to specify.

3 Results

A total of 94 individuals participated in this study. Over half (53.2%) of the participants were of age 16-24 years.

3.1 Information channels generating demand for VMMC

Table 1 describes the various communication channels that generated VMMC demand at NCH. Participants who were 16-24 years were mainly motivated by Community leaders (22.3%), Television (22.3%) and Friends (20.2%). The 25+ year's age group cited Television (18.1%), Radio (18.1%) and Friends (18.1%) as the channels that generated most of their interest. Overall, the highest demand to undergo VMMV was generated by Television (40.4%), and this was followed by community leaders (38.3%) and radio (33%).

Table1. Communication channels that generated VMMC demand and their association with age group

Communication channels	Response	Age group		Total n (%)	Overall Ranking	p-value
		16-24 n (%)	25+ n (%)			
		TARGATED ADVOCACY				
Politicians	Yes	1 (1.1)	4 (4.3)	5 (5.3)	**11**	0.14*
	No	49 (52.1)	40 (42.6)	89 (94.7)		
Celebrities	Yes	7 (7.4)	2 (2.1)	9 (9.6)	**8**	0.11*
	No	43 (45.7)	42 (44.7)	85 (90.4)		
Community leaders	Yes	21 (22.3)	15 (16.0)	36 (38.3)	**2**	0.431
	No	29 (30.9)	29 (30.9)	58 (61.7)		
		MASS MEDIA				
Radio	Yes	14 (14.9)	17 (18.1)	31 (33.0)	**3**	0.270

	No	36 (38.3)	27 (28.7)	63 (67.0)		
Television	Yes	21 (22.3)	17 (18.1)	38 (40.4)	**1**	0.740
	No	29 (30.9)	27 (28.7)	56 (59.6)		
SMS	Yes	0 (0)	4 (4.3)	4 (4.3)	**12**	0.450*
	No	50 (53.2)	40 (42.6)	90 (95.7)		
Newspapers	Yes	2 (2.1)	6 (6.4)	8 (8.5)	**9**	0.141*
	No	48 (51.1)	38 (40.4)	86 (91.5)		
Magazines	Yes	2 (2.1)	5 (5.3)	7 (7.4)	**10**	0.246*
	No	48 (51.1)	39 (4.5)	87 (92.6)		
Billboards	Yes	4 (4.3)	6 (6.4)	10 (10.6)	**7**	0.507*
	No	46 (48.9)	38 (40.4)	84 (89.4)		
		MID-MEDIA				
Public announcements using loud speakers	Yes	15 (16.0)	10 (10.6)	25 (26.6)	**4**	0.426
	No	35 (37.2)	34 (36.2)	69 (73.4)		
Speeches	Yes	3 (3.2)	2 (2.1)	5 (5.3)	**11**	1.000
	No	47 (50.0)	42 (44.7)	89 (94.7)		
Special promotion events	Yes	1 (1.1)	8 (8.5)	9 (9.6)	**8**	0.011*
	No	49 (52.1)	36 (38.3)	85 (90.4)		
Posters	Yes	12 (12.8)	9 (9.6)	21 (22.3)	**5**	0.680
	No	38 (40.4)	35 (37.2)	73 (77.7)		
Drama group presentations	Yes	8 (8.5)	1 (1.1)	9 (9.6)	**8**	0.034*
	No	42 (44.7)	43 (44.7)	85 (90.4)		
		INTERPERSONAL RELATIONSHIPS				
Parents	Yes	14 (14.9)	5 (5.3)	19 (20.2)	**6**	0.045
	No	36 (38.3)	39 (4.5)	75 (79.8)		
Spouse	Yes	0 (0.0)	3 (3.2)	3 (3.2)	**13**	0.099*
	No	50 (53.2)	41 (43.6)	91 (96.8)		
Girlfriend	Yes	3 (3.2)	4 (4.3)	7 (7.4)	**10**	0.702*
	No	47 (50.0)	40 (42.6)	87 (92.6)		
Friends	Yes	19 (20.2)	17 (18.1)	36 (38.3)	**2**	0.950
	No	31 (33.0)	27(28.7))	58 (61.7)		
Workmates	Yes	4 (4.3)	6 (6.4)	10 (10.6)	**7**	0.507*
	No	46 (48.9)	38 (40.4)	84 (89.4)		
Counseling	Yes	4 (4.3)	4 (4.3)	8 (8.5)	**9**	1.000*
	No	46 (48.9)	40 (42.6)	86 (91.5)		
		OTHERS				
Internet, Family members, Medical personnel	Yes	1 (1.1)	2 (2.1)	3 (3.2)	**14**	0.452*
	No	49 (52.1)	42 (44.7)	91 (96.8)		
Number of respondents		**50 (53.2)**	**44 (46.8)**	**94 (100)**		

Note: (*) represent P-value calculated from Fishers Exact Test

3.2 Association between age and communication channels

Special promotion events (p=0.011), drama group presentations (p=0.034) and parents (p=0.045) were significantly associated with the age (Table 1). Parents and drama group presentations were significantly associated with the 16-24 year age group while Special promotion events were significantly associated with those who were 25 years and above.

3.3 Adequacy of first time information in generating demand

The majority (78%) of the participants said they had to seek second opinion before they decided to undergo VMMC (Table 2).

Table 2. Adequacy of first time information to generate demand for VMMC

Response	Frequency	Percentage (%)
Yes	21	22.0
No	73	78.0
Total	**94**	**100**

3.4 Better promoters of VMMC (men or women).

As shown in Table 3, 66% of the participants believe women are better promoters of VMMC than men.

Table 3. Assessment of whether women are better promoters of VMMC than men

Response	Frequency	Percentage (%)
Yes	62	66.0
No	32	34.0
Total	**94**	**100.0**

4 Discussion

The current study revealed that Television (40.4%) was the channel of communication through which the majority received information that made them seek VMMC. Television was followed by community leaders (38.3%) and radio (33%). This shows that mass media channels, particularly television and to a lesser extent, radio are cardinal in communicating concise messages that encourages men to seek VMMC at NCH. In a study [4] done in Zimbabwe, participants had mostly learned of VMMC from radio (71.4%) and television (40.4%) campaigns. Another study [5], done in Tanzania indicated that the best mode of communication channel for VMMC messages was the radio. The difference in the findings of this study with those from the previous studies is most probably due to the different community setups in which the studies were conducted. It is likely that there were more televisions in the current study area than in the previous study areas. It's imperative, therefore, that both television and radio campaigns are intensified so that many more people can learn of the benefits of male circumcision and therefore seek to undergo the procedure. Community leaders under the targeted advocacy, was the second most frequently mentioned communication channel. It is interesting to learn that leaders in the community also have a big role to play in encouraging men to go for VMMC. Many young people regard elders in the community to be full of wisdom and insight, and this is probably the main reason why they have a large influence on the men's desire to undergo VMMC. The leaders of our communities should be encouraged to acquire more knowledge on VMMC so that many young people who are skeptical about the procedure can have clear understanding. It would be beneficial for the government to come up with training programs to equip the elders/leaders in the community with enough information about VMMC so that they may disseminate this information to the public.

The majority of communication channels had no association with the age group except for special promotion events, drama group presentations and parents. Special promotion events were mostly associated with participants who were of age 25 years or older while parents and drama group presentations had an association with the younger age group (16-24 years). This is consisted with what was reported [3] in South Africa that demand creation for VMMC services in men over the age of 25 is more difficult in some settings than for the younger men.

Another important revelation that this survey brings forth is that the majority of clients (78%) believed that the information they received the first time they heard about VMMC wasn't enough to stimulate their desire to seek undergoing the procedure. Only 22% had interest in VMMC the first time they heard it.

This finding raises a question; could it be that most of the messages in the communication channels currently in use are not concise and precise enough to communicate adequately or could it just be that people are always skeptical about something until they hear it multiple times and from different sources? This question may remain a subject of further research. However, this study helps to establish that it may be important to use several channels of communication so that VMMC can be heard on different platforms thereby enhancing the effective communication of the VMMC messages.

It is encouraging to learn that women are an important factor in driving men to seek VMMC. Though this study did not establish which category of women (girlfriends, wives, sisters, mothers, etc) influence men to undergo the procedure, it did underscore the fact that they have a great role to play in the scale up of VMMC campaigns. About two thirds (66%) of participants believed that women are better promoters of VMMC than men. This is concurrent with a study [6] which revealed that the majority of women (69%) were willing to have their partners circumcised while 81% were willing to have circumcision done on their sons. The Zambian government desire to involve female partners of uncircumcised men to play a crucial role in encouraging men to seek VMMC services. The government has made it a priority to involve women in all communication and advocacy activities that can help in generation demand for VMMC services. [7] The study therefore helps to emphasize the necessity of involving women in the various communication channels that are to be used in accelerating VMMC campaigns.

The limitation of this study is that the results cannot be generalized because everyone was captured. We don't know if there could be differences from others who didn't take part in the study. We are unable to establish the extent of bias and its direction.

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Journal of Health Informatics in Africa

Organizational Capacity Building for Sustainable Health Information Systems: A Case Study from Ghana

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Background and Purpose: Implementing ICT innovations especially in low resourced countries has been documented in the information systems (IS) literature as a very challenging feat because of the existence of weak organizational structures leading to manifestations of silos of fragmented country ICT projects lacking the basic organizational structures to scale and become sustainable over time [31, 11, 33]. In 2010 Ghana adopted the DHIS2 software as a replacement of the existing and challenged health information system (HIS) to enable it track progress on the health related millennium development goals (MDG). The outcome has been a successful nation-wide implementation of HIS in all public health facilities. This paper looked at the factors that enabled the successful implementation and sustenance of the adopted software in Ghana.
Methods: Concepts from information infrastructure theory and the notion of the installed base were used as lenses to collect and analyse the empirical data. Data collection and analysis was qualitative using participant observation, focused group discussions, semi-structured interviews and document analysis.
Results: This has been possible because of realignment of selected elements of the installed base necessary for achieving set objectives. For Ghana the elements identified were manpower development, resource mobilization, strengthening of institutions and networking with stakeholders to leverage on available resources and technology.
Conclusions: Sustainability of HIS in resource constrained contexts requires selection of elements of the installed base necessary for effective organizational capacity building. And these elements must be interdependent otherwise the objective of sustainability might not be accomplished. Effective capacity building efforts of an organization therefore involves combining strategies synergistically to ensure long-term sustainability.

Keywords: Organizational Capacity Building, Installed Base, DHIS2

1 Introduction

Recent developments in information, communication and technology (ICT) have brought into focus organizations, governments and policy makers leveraging on ICT for their developmental agenda [45]. Literature on information systems (IS) abound with examples in researches into the development of complex large scale ISs called the information infrastructures (II) in areas such as commerce, telecommunication, banking, mining, health and so on [9]. The objectives of these technological innovations are mostly to either solve system problems or improve upon existing systems. The health sectors in developing countries have seen many of such ICT innovations enacted by different actors for improving healthcare delivery and reporting [11, 20, 48, 39].

With respect to health the different actors within the health organization field come with their own parochial agenda which come to bear on the introduction of such ICT innovations in their respective settings. Invariably these innovations come in the form of conditional aid packages which are at variance with individual country or organizational developmental agenda. Most of these initiatives have been pilot projects which by and large have not been able to scale in their respective contexts when project time elapses. These have resulted in IS 'silos' doting the IS landscape [28, 31, 33].

In the past two decades developing countries have seen increased activities in modernizing their ISs. In the health sector there has been the urgent need for some countries for example Ghana to honour their

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 J Health Inform Afr. 2015;3(2):30-36 , 10.12856/JHIA-2015-v3-i2-127

international obligations as signatories to international conventions and chatters, for example the MDGs [31, 1, 11, 16]. For informed decisions as to progress towards achieving set MDG targets, data has been seen as crucial and this has compelled governments and health ministries to restructure their health sector to improve upon the quality of health service delivery and data reporting. This is amid health systems in developing countries which are generally struggling with multiple and overlapping inefficient parallel or siloes of information systems [30, 49, 38].

Broadly speaking health information connotes information on the health status of the population, health services, resources and other factors that affect health. Health information system therefore includes procedures, equipment and human resource involved in data generation, collection, processing and provision of information to health workers and the population at large for making informed decisions [2, 6]. Consequently, the success or failure of any health care system is contingent on the quality and soundness of the health information system or [31, 11, 13, 16]. By extension it is therefore expected that a sound and quality HIS should necessarily have the capacity to generate quality data and information to enable informed decision in the health sector [2, 6].

Information infrastructures evolution among other characteristics depends on the installed base [29]. Health information systems conceptualized as an II evolve on their installed bases consisting of people, institutions, artefacts, stakeholders, the health sector as an organization, and so on, which are involved in the process of continuous change [29]. Organizational actors function within organizational fields and are governed by formal and informal institutions [42, 46]. Actors central to this study are the DHIS2 application, the GHS as an organization, stakeholders, and existing and emergent institutions. This study conceptualizes the realignment of the elements of the installed base for continue change and sustainability of HIS implementation as organizational capacity building. In developing country settings such as Ghana focus will be on the interactive effects in the capacity building process by looking at manpower development, existing and emergent institutions, formation of networks, and resource mobilization. This is line with suggested framework in the literature and findings will therefore be contributing to this body of work [21, 18].

2 Materials

2.1 Capacity Building

Capacity building is a cross-cutting concept and pervasive in all human endeavours which has been well researched in different fields [21, 18, 37]. Being a multidimensional concept its application has varied conceptualization but the underlying components or principles remain the same irrespective of the field of application. Capacity by definition refers to the overall aptitude of the individual or organized group to perform assigned responsibilities [21]. Inherent in this definition is the attribute capability or ability which refers to the knowledge, skills and attitudes of the individual or group, and their competence to undertake assigned responsibilities [21, 43].

Performance of responsibilities in this regard is not dependent only on the capabilities of the people but also on the overall nature of the tasks, available resource and the institutional arrangements within which these responsibilities are discharged [21,43]. In the health sector for example it is common to have highly skilled and capable staff but who do not have the capacity to function appropriately due to lack of resources and ineffective institutional arrangements. Therefore strengthening institutions and developing the capability of people in an organization must be seen as fundamental in capacity building efforts of the organization. These are done essentially through education and training of the human resource across all levels and strengthening of the managerial systems through consolidation of existing institutions and enacting new ones where necessary, and the provision of knowledge for the execution of assigned responsibilities. In effect capacity can be seen as both the organizational or sociocultural arrangements and the technical capabilities that allow organizations to carry out their functions [43].

From the foregoing therefore capacity building can be defined as a dynamic and multidimensional process of organizational change through an integrated approach of strengthening individual or group skills and abilities, formal policies, systems, practices, symbolic actions, networking, beliefs, values and attitudes [43]. This broad definition of capacity building enables different approaches to how organizations could fashion their capacity building efforts. In the literature reviewed one could identify

some common strategies to the concept under the disguise of different terminologies and which are also context dependent. For example in a health promotion study [18] (Crisp et al, 2000) suggested using the following approaches for capacity building ; a top-down organizational approach for changing policies, a bottom-up organizational approach for provision of skills to staff, a partnership approach for strengthening inter-organizational relationships, and community participation approach for improvement of health in the community. In a related work [21] (Franks, 1999) in developing capacity in the water sector at the Deft Conference on water resources, similar components were identified as appropriate for the sector; that is, the creation of an enabling environment with appropriate policies and legal frameworks; human resource development and strengthening of managerial systems; and institutional development, including community participation.

2.2 Installed Base

Information infrastructures have inherent complexities and cannot be built from scratch but cultivated from the existing structures or systems. In contemporary organizations however ICT solutions and their developments are complex because they incorporate many technological elements, have large user bases, and are usually built or developed on existing configuration of information infrastructure components called the installed base [50, 47, 39]. The installed base is the totality of the existing infrastructure prior to the introduction of an ICT solution into an organization. This consist of the organizational set up as a group, the governing institutional structures, material elements such as paper and equipment, human and financial resources, existing coalitions and networks, physical infrastructure, and so on and so forth. It is the configuration of these components which forms the foundation or base on which the perceived II sits, nurtured and grows and this can be experienced as inertia to the change process. Whatever is added needs to be integrated and made compatible with this base and this sets up demands for compatibility and imposes constraints on what can be designed at any given time [39]. Therefore to study the evolution and sustainability of an II such as DHIS2 application in our case it is essential to take into consideration the components of the installed base.

2.3 Research Objectives

The objective of this research is then to analyse the organizational capacity building efforts for sustaining a recently deployed national data warehouse application within the GHS [21, 8, 18, 19]. To do this we frame the research problem as: How can the implementation of ICT innovations be sustainable in resource constrained contexts? Ghana is a developing country that depends heavily on donor funding for its developmental agenda and aspires to be a middle income country by the year 2020. In addition to this national goal it also has other international commitments, for example, attaining set targets for the millennium development goals (MDGs) by the year 2015. Information Communication and Technology (ICT) has been identified as key to all these national efforts. For the Ghanaian context the study focus will be on manpower development, strengthening of institutions, mobilization of resources, and partnerships through networking. The study will follow the implementation of the DHIS2 data warehouse application by evaluating essential components of the installed base for sustainability as it evolves.

The rest of this paper will be as follows; a description of the materials, context and the research approach. This is followed by the results, discussions and some concluding remarks.

3 Research Context

This is a longitudinal study that started in 2010 and is still ongoing. The GHS undertook a major restructuring of its HIS to enable it measure progress towards achieving set targets for the health related MDGs 4, 5 and 6, and also improve upon the quality of the routine health service data it generates to enable it make informed decision [3, 4]. Different stakeholders are involved in the provision of healthcare in Ghana and these include the government (public), private, quasi government, faith-based and traditional medicine practitioners. Among these it is the government/public which is the largest health care provider [3].

Healthcare provision in the public sector is three tiered. At the primarily level are the community-based health programmes and services (CHPS) compounds and health centres (HC) which provide both preventive and curative health services through static clinics and outreach programmes to the communities [24, 25]. The secondary levels comprise the district and regional hospitals and the tertiary levels are made up of the teaching hospitals and specialized facilities such as leprosaria, psychiatric hospitals and cardio centres. For this study the emphasis will be on the public sector where the DHIS2 application was implemented. As a result of healthcare providers offering service to clients, data is generated and this is collected and managed using the DHIS2 which is locally called the District Health Information Management System (DHIMS2). The study will look at the organizational structures that enabled successful implementation and continued sustenance of the DHIS2 application in Ghana.

4 Research Methodology

This paper is the outcome of HISP involvement in the implementation of DHIS2 application in Ghana as a result of partnership between the GHS and the University of Oslo, who are the developers of the software. The main motivation of the HISP network stems from the strand of action research practiced in Scandinavia where the researcher is actively engaged in a real-world context with the quest for new knowledge whilst improving the context through cyclical problem diagnosis, designing, implementing interventions and evaluation of the outcomes [10, 7]. Through many years of practice the "networks of action" concept was also developed by [11] (Braa et al, 2004), to describe the action research process within HISP. The main tenet of the ‘network of action’ concept is the importance of sharing knowledge among nodes in the network to ensure sustainability over time and space.

I have been actively involved in the implementation of this project since 2010 to date and have had the opportunity to interact with the system and its environment at different levels. I have also participated in systems development, training of end-users and implementation country-wide. Such close involvement in this project has given me the opportunity to observe systems activities, access documents, discuss and interview many stakeholders at different levels over time and space.

4.1 Data Collection

Data collection has been through different qualitative data collection methods such as stakeholders’ consensus building fora, customization of the DHIS2 to DHIMS2, training of end-users, participation in annual review processes and other meetings, participation in integrated quarterly monitoring and evaluation exercises to the regions, districts and facilities, focus group discussions with end-users, interviews and analysis of documents. Interviews were interactive and were used in an attempt to have a deeper understanding of the issues being studied [36]. Over the years I have also had many discussions and interviews (formal and informal) with National Divisional/Programme Heads, District Directors of Health Services (DDHS), Regional Directors of Health Services (RDHS), health facility heads, Public Health Nurses (PHN), Disease Control Officers (DCO), Health Information Officers (HIO) and Biostatistics Officers (BSO). Informal discussions were also held with peers, stakeholders and national representatives regarding emerging trends in HIS in the GHS and Ghana as a whole.

Depending on the calibre of staff views were sampled from participants on the software application performance, activities surrounding data management and strategies that will ensure system sustainability. Discussions were also held on issues on data quality and data use, integration prospects (especially for the stand alone programmes such as TB, HIV/AIDS and Malaria), collaboration (internally and externally), resource mobilization for data processing, local training initiatives to build capacity of staff, constraints and how in the participants view DHIS2 application could be sustained over time. During all these visits and end-user encounters field diaries were used to take field notes which were later transcribed for analysis. Bias in the research was also reduced by providing feedbacks to key respondents and revisiting some research sites [36, 40].

4.2 Data analysis

In qualitative research data collection and analysis goes on concurrently as there is no clear distinction between the two in that the data analysis affects the data and the data affects the analysis in significant ways [41]. This research is interpretive and qualitative in nature hence the data was analyzed using hermeneutic approach where text from interviews from the field were transcribed, reduced, categorized and displayed in order to find patterns in the data [40, 36]. From these themes and trends were identified and explained in the findings. These themes were on perceptions, advantages and disadvantages of the system, issues of the system relating to data quality, organizational influences, governance and recommendations for system improvement and sustainability. The data collection and analysis were all guided by the underlying theoretical concepts. Having been involved in all the implementation processes also gave me better insights and knowledge on issues that would not have been possible otherwise.

5 Research Findings

Capacity is here conceptualized as both the organizational arrangements and the technical capabilities that allow organizations to carry out functions related to set objectives [43]. Many studies have been conducted on capacity building (CB) in organizations and the findings of these studies are that capacity building is a multidimensional concept and contextual for the simple reason that organizations are idiosyncratic in their operations and formation [32, 17, 34, 43]. Because of these characteristics studies in capacity building assume different approaches contingent on contextual influences. Despite the differential approaches to studying capacity building in organizations studies have shown the existence of some cohesion. These could broadly be classified as manpower base, institutional arrangements, availability of resources, and formation of coalition or networking with stakeholders. Furthermore, these categorizations are interdependent to form a complex whole and cannot be appreciated in isolation [32, 17, 34, 43]. This study draws on the above suggested classifications to evaluate the organizational initiatives of the GHS which have facilitated the successful implementation and sustenance of the DHIS2 data warehouse application in the public healthcare service in Ghana.

5.1 Manpower Development

Human resource development is fundamental to the success or failure of any developmental agenda and key among the range of strategies for improving skills and competencies of the workforce in an organization is through continuous training and education [43, 21]. In the context of Ghana and the implementation of the DHIS2 application these took different trajectories and levels.

The DHIS2 software is structured in modules which enable it to be adapted to different contexts. Having identified the modules suitable for the GHS a technical team was constituted made up of staff from the Centre for Health Information Management (CHIM), the department in the GHS responsible for managing health service data, to customize the DHIS2 application to suite the Ghanaian context. Members of the team are from backgrounds such as statistics, disease control, computer science, health informatics, epidemiology and biostatistics. This background-mix was necessary for the customization process because of the inherent complexities in the health sector. The objective of the formation of a team from the CHIM to facilitate the customization is to strengthen the human resource base by developing skills internally within the GHS for future maintenance and sustainability of the DHIS2 application.

For the skills development efforts first a consultant was engaged for two weeks to introduce the team to the software after which a prototype was built for demonstration to the management of the GHS of the feasibility of the project. Second, based on this initial tutorial a technical assistance was provided through networking with the HISP group in the University of Oslo. This coalition with the HISP facilitated completion of the customization of the DHIS2 application for deployment in all public health facilities (and some private, mission and quasi-government health facilities) and health directorates (district, region and national) in the country [3].

After systems development end-user training was conducted in batches at different levels consisting of staff at the regional, systems administrators at regional and district levels, and all headquarters staff who are involved in data processing and management. Composition of the regional training consisted of users from the regional health directorate (RHD), district health directorates DHDs in the region, all hospitals in

the region, all special programme coordinators, and all departments who generate health data as result of the services they provide e.g. Family Health, Nutrition, Disease Control, EPI, surveillance, etc. Special training was also given to systems administrators at the various levels i.e. RHDs, DHDs, hospitals and special programmes, to enable them administer the system at these levels. The content of the administrators training consisted of tasks such as granting user access, running data quality checks, maintenance of organization unit structure and generation of reports for management and stakeholders.

The thinking behind this broad spectrum of training was to make data open, accessible and transparent to end-users. It is also to enable all departments generating data to enter their own data since they understand their data better than the HIOs who hitherto has been responsible for all data entries thus reducing the workload on the HIOs who will then dedicate more time to data analysis and quality issues. As trainer of trainers (TOT) HIOs are also expected to function as resource persons to cascade end-user training to the lower levels when resources are available. Even though data entry is supposed to be at the district level observation in the field was that some districts have taken the initiative to provide the necessary resources down to the CHPS compounds, which is the lowest level for service delivery at the community, to enter their own data in the DHIS2 application thereby bridging the gap in data flow and compensating for some data transmission errors and challenges in the paper-based HIS.

As a policy directive data quality assurance teams are formed at each level starting from the CHPS compound through to the national level. The mandate of these teams is to ensure that data generated is vetted for quality before entry in the DHIS2 application. Heads of the data quality teams who normally are the facility managers are also expected to develop skills in data analysis and use especially at the facility levels where data is generated. Data use seems to be gradually gaining grounds as this was evident from simple graphs on selected health indicators which could be seen adorning the walls and notice boards at most facilities visited.

The curricula at the various MOH educational institutions also have components on health statistics and biostatistics where students are given introductory courses in these disciplines in relation to health information. Other specialized MOH educational institutions such as Kintampo Rural Health School, University of Health and Allied Sciences (UHAS) and the School of Public Health, University of Ghana, have courses in health informatics where students are trained to take up positions as health information officers in the health sector. As a long term plan there exist bilateral agreements between the GHS, University of Ghana and the University of Oslo for academic programmes in the field of information systems and research to train Ghanaians in these fields at the masters and the doctorate levels [3].

5.2 Resource Mobilization

At the heart of any successful HIS project is the availability of resources both human and material. Provision of material resources is correlated to access to financial resources without which HIS projects cannot be initiated. Ghana is a developing country and heavily dependent on foreign grants and loans for the implementation of national development initiatives including health programmes. The pursuit for a viable and efficient HIS for the GHS has been a major challenge with respect to acquiring the necessary financial mainstay for the commencement of the initiative. The defunct health management information system (HMIS) was proprietary software which had many challenges [3, 44, 4]. The decision on adopting FOSS was as a result of lack of funds for maintenance when the project ended. The previous proprietary HMIS was project funded by the European Union (EU). And when the project elapsed it became difficult to maintain it to accommodate emerging requirements from stakeholders [3, 44, 4].

Through networking with health partners the GHS secured the necessary financial support to implement the DHIS2 application. The financial support enabled broken down ICT equipment to be refurbished or replaced, end-user trainings to be conducted, the provision of logistics for monitoring and evaluation of activities at project sites, and payment for server hosting. The Government of Ghana on its part provided the human resource, physical infrastructure, other logistics and payment of staff salaries.

5.3 Strengthening Institutional Structures

Institutions are said to be cognitive, normative and regulative structures and activities that provide stability and meanings to social behaviour [46]. Organizations and the organizational field such as the GHS and its partners constitute an institutional life [46]. Institutions are therefore the regulative

frameworks, managerial practices and norms that enable organizations to function and endure [46, 42]. With reference to the GHS and DHIS2 application there exist the e-governance policies for government within which all e-projects in-country must comply with. From this the MOH/GHS has developed the Enterprise Architecture with e-health component that governs all its e-health projects.

At the operational level the GHS has also developed the Standard Operating Procedures (SOP) for health service data management. This document on SOPs provides a formalized system for evaluating the technical adequacy of data collection, collation and analysis. These activities start before data collection and continue after analysis are completed and require continuous and evolving coordination and oversight. These procedures outline how to keep records and obtain accurate, complete as well as thorough documentation of all activities in the GHS [27]. It also specifies the minimum data quality and quantity requirement as well as the procedures that will be used to analyse and report those data. The main objectives of the SOPs are therefore to maintain a reliable data quality system for the GHS, provide a current accurate data required by the service, donors and other stakeholders, and provide a record keeping system that will help evaluate and monitor promptly and allow for effective resolution of concerns and issues on on-going active programmes [27].

Other institutional strengthening mechanisms are institutionalization of peer reviews among directors and superintendents of health services, budget management centres (BMCs), and health information officers. The directors meeting which is dubbed Senior Managers Meeting (SMM) is a biannual institutionalized affaire at which all managers of health services in the country meet to deliberate on the stewardship of their respective jurisdictions. Similar peer review meetings are held at facility, district, regional and national levels on quarterly, semi-annual and annual basis [4]. The HIOs also hold their separate quarterly meetings just as the previous two groups. At all of these gatherings presentations are made based on the sector-wide indicators which the MOH/GHS track each year on the basis of service provided and these are subjected to review by peers.

The RHIOs on their part now have an added responsibility of generating quarterly publications e.g. bulletins, on their activities based on these service indicators for their respective regions. The production of this bulletin on time determines release of funds for regional monitoring of health programmes and activities for the quarter. These peer review mechanisms coupled with the institutionalization of quarterly regional league tables have tremendously facilitated to improve the quality (completeness, timely, consistency and accuracy) and use of routine health service data [4]. In addition the regular quarterly regional monitoring and evaluation exercise jointly undertaken by national and regional officers has also facilitated the overall data management improvement process within the GHS.

Developing and implementing an information infrastructure such as the DHIS2 data warehouse application takes a lot of effort and resources and the end product and the IT infrastructure needs protection and security in case of a disaster. The II is an important resource of an organization and must be properly secured [26]. As part of health systems strengthening activities during the implementation of the DHIS2 project the GHS developed a Disaster Recovery Plan (DRP) containing comprehensive statement of consistent actions to be taken before, during and after a disaster. It is an evolving document that contains a set of procedures to recover and protect the information technology infrastructure of the GHS in the event of a disaster in order to recover IT data, assets and other infrastructural facilities. The DRP document also contains policy guidelines in relation to accessibility to cooperate data, information and use. This is to espouse ethical issues with regards to patient data confidentialities.

5.4 Networking

For sustainability of interventions such as implementation of HISs in resource constrained contexts invariably depends on building coalitions both at the micro and macro levels, and this creates opportunities for utilizing these partnerships to strengthen the capacity of organizations in the process [18, 11]. Coalition building or networking is based on the assumption that providing possibilities for the two-way flow of knowledge between nodes in the network can lead to sharing of available resources for planning and implementing health projects. The traditional alliance with health partners such as World Health Organization (WHO), Japan International Cooperation Agency (JICA), the United Nation (UN) Bodies, Global Fund, World Bank (WB), etc. have been providing financial support to programmes in many developing countries. It was inferred from the data gathered for this study that donor fatigue has set

in such that the amount of funds being released by donors currently is decreasing therefore governments and organizations need to be more innovative in attracting funding for health programmes.

Strategy	Benchmark	Outcome
Manpower	• Skills development • Incentives	• Training (technical team, end-users, HISP academy and educational programmes) • Working tools, personal emoluments, feedbacks on operations
Resources	• Infrastructure • Financial	• Buildings, equipment, other logistics • Operational funds
Institutions	• Policies • Enabling environment	• SOP, DRP, EA, Peer reviews, quarterly integrated M&E, etc. • Conducive working environment
Networking	• Internal collaborations • External coalitions	• MDAs, Earmarked health programmes (HIV/AIDS, TB, MCP, etc.), educational institutions • Global health partners, Global Infrastructure (HISP)

Table1. Framework for Assessing Organizational Capacity Building Initiatives in Ghana

Newly established partnership with HISP has open new capacity building opportunities for the GHS in the area of technical assistance through knowledge transfer and education. In addition to providing the TA for customizing the DHIS2 application for the GHS the HISP group is also providing training on advanced features of the application through the HISP regional academies in West Africa. For sustainability and eventually becoming self-reliant and less dependent on the HISP technically, the GHS has taken the initiative, by leveraging on the TA from HISP, to build the skills of its core technical team in server administration of which the first training session took place in January 2013 and has been recurring when the need arises. In the memorandum of understanding (MOU) between GHS and University of Oslo, fellowships are also to be provided for higher education in information science and research. This is to be seen as a strategic plan to build the skills of Ghanaians in these fields so that eventually the GHS weans itself from dependency on external assistance to become self-sufficient.

6 Discussions

Each of the approaches analysed in this paper incorporates a range of strategies for accomplishing elements of organizational capacity building initiatives. It will therefore be necessary to consider mechanisms to establish whether capacity building did occur and whether the occurrence has elements of sustaining the DHIS2 implementation in Ghana. Studies on capacity building in organizations have shown that such evaluation procedures are contextual and vary from organization to organization. However, irrespective of the approach, the ultimate question which emerges when assessing attempts at capacity building is whether changes that have taken place in the organization as a result of interventions are sustainable [21, 43, 18, 11]. **Table 1** shows the framework used in assessing the capacity building initiative by the GHS when the DHIS2 application was implemented.

Humans are central to every organization's development hence it was of little surprise to observe that the competence and skills development of the workforce of the GHS is crucial in its capacity building efforts. Enhancing this capability will depend on effective education and training and on equipping individuals with the ability to learn continuously. These were evident on the premium put on training programmes at different levels, and the formation of core teams for systems management at district, regional and national levels as short to medium term measures to initiate and maintain project implementation.

Organizational capacity building is an evolutionary and dynamic process in the growth of an II such as the DHIS2 application. Therefore the GHS for its long term plan has networked with the HISP group and the University of Oslo for continuous refresher trainings on new release versions of the DHIS2

application through its regional academies and online tutorials. Technical assistance for specific requests on in-country trainings as in the case of the periodic server trainings and educational opportunities through scholarships for the staff of the GHS at the post graduate levels are seen as innovative ways of cultivating the installed base with respect to skills development in order to strengthen and sustain the DHIS2 implementation in the country. These long term educational programmes could be the critical factor for increasing the knowledge base through the development of research capacity of beneficiaries who might assume academic positions in Ghanaian educational institutions to impact knowledge to others.

The existence and evolution of IIs is interlinked with defined standards and this has generated much interest in studies in standardization strategies [29, 14]. Standards are accepted ways or norms or procedures of doing things and for II development these must be generic and flexible in application [14]. Institutions are the lifeline of organizations and IIs development and if IIs are to persist and scale its institutions must be strengthened. The implementation of the DHIS2 application in Ghana has seen the emergence and strengthening of standard institutions such as SOPs, e-health policy, DRP, data accessibility policy and empowerment of health staff to be enrolled in the DHIS2 application space. The creation of an enabling environments and legislative frameworks are indeed essential components of organizational capacity building blocks for enhancing DHIS2 application development and implementation. No matter how competent and committed an organization's workforce, it needs to be able to work within a supportive environment. In addition the workforce must be adequately recompensed to enable it to deliver [21].

Networking with health partners both internally and externally had enabled the implementation of the DHIS2 application in a resource constrained country like Ghana. Donors financed all the end-user training programmes and this was the component which took the chunk of the DHIS2 implementation budget. Their participation was crucial as central government was not having the necessary funds for a national project such as this. Partners continue to support post implementation efforts such as routine monitoring and evaluation activities to sustain the system. For example the World Bank (WB) released funds in 2013 for the integration of the e-Tracker which is an individual client mobile medical record system for supporting maternal and child health service at the community level into the DHIS2 application [5]. This development is significant in the sense that it will enable the e-Tracker as a module of the DHIS2 application to scale nationally. The reason being even though it is being piloted in just some few districts currently by virtue of being part of the DHIS2 application it will automatically be available to end-users throughout the country since the DHIS2 application is a web-based system and accessible from a central web server.

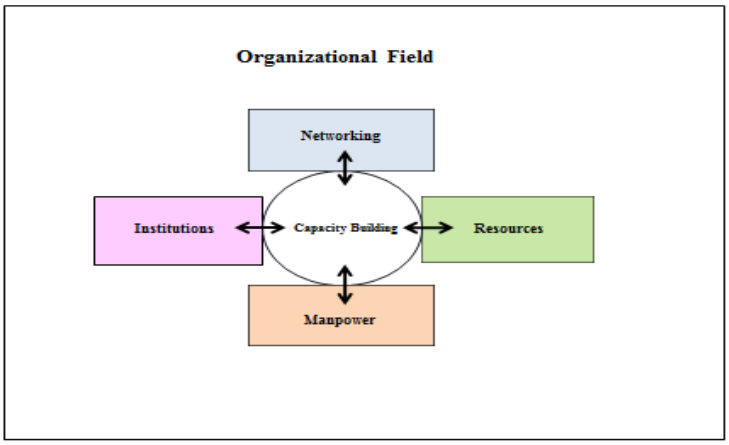

Fig.1. Interlinkages in Organizational Capacity Building Components

Organizational capacity building efforts must necessarily embody the element of sustainability [17]. In this study it has been observed that the overarching factor for a sustainable HIS is the interdependency among the organizational capacity building components identified for a given context (**Figure 1**). For example human resource is the mainstay of every organization and this is the same for the health sector. Therefore high staff attrition due to unfavourable working environment and other extraneous factors will obviously lead to challenges in the operations of the organization and consequently the II. Again in Ghana

this project has been successful primarily due to the coalitions that the GHS has forged with the HISP group and its health partners of which a breakdown in such coalition might lead to breakdown in the evolution and growth of the II [29]. The IS literature gives many examples of HIS projects which have either failed or are still in their pilot stages after many years of implementation. This might probably be due to lack of interdependency among the components of the specific organizational capacity building efforts [31, 35]. Consequently for a sustainable HIS there is the need to preserve the relationship between all identified components of the organizational capacity building efforts in lieu of this the II is bound to founder.

7 Concluding Remarks

This paper describes four approaches to organizational capacity building initiative for the implementation and sustainability of HIS in a resource constrained country such as Ghana. The four approaches identified and used by the GHS to successfully customize, implement and maintain the DHIS2 application in all government and some private health facilities were manpower development through training and education, mobilization of resources both human and material, strengthening of existing institutional frameworks and enactment of new ones, and building networks through partnership with the HISP group and other stakeholders in healthcare [11]. Concepts from information infrastructure such as the installed base and cultivation with regards to selected elements of the installed base were used as lenses for data collection and analyses to ascertain sustainability of the DHIS2 application in Ghana.

For a sustainable implementation of HIS in a resource constrained countries for example Ghana, adoption of the approaches in the organizational capacity building process in the specific context must be interdependent without which the objective of sustainability might not be accomplished. This is because, for example in Ghana's case, a delay in scheduled donor financial support for retraining of end-users in new release versions of the DHIS2 application occasioned some challenges resulting in some districts not able to use the system with resultant data quality implications.

Again for this network to also endure it is imperative that the nodes in the network are constructively engaged continuously. The findings also suggest that organizational capacity building is not simply the provision of training opportunities, workshops and enacting institutions that lead to short-term outcomes. Effective capacity building efforts of an organization involves combining strategies synergistically to ensure long-term sustainability.

Since its introduction in Ghana in 2010 one can infer from this study that the DHIS2 has evolved over the years and has been sustained by the structures put in place by the GHS. It started as an aggregated system and has metamorphosed and capable of storing both aggregated and patient-based data. The organizational structures, even though not perfect and have their peculiar challenges, have withstood all the odds and have enabled the system to diffuse from the district to the community level where routine health service data (maternal and child health service data) could be entered by community health workers (CHW) [5]. This unique development has certain implications in relation to data quality because it reduces some of the error prone processes in the data flow from point of generation to the next and higher levels. For example data collation on paper summary sheets for onward transmission to the district for electronic input into the DHIS2 application for maternal and child health (MCH) programmes is in the process of being stopped in some districts. This is because MCH records are being entered into the DHIS2 application at the community level as a pilot and later to be scaled nationwide since the MCH paper registers has been digitized as part of the DHIS2 application.

Acknowledgement

My appreciation goes to the Ghana Health Service for granting the permission for the conduct of this research at its facilities and to the Global Infrastructure Group for funding the research.

Statement of conflict of interest

I will like to state that there were no conflicts of interest in the conduct of this study.

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Journal of Health Informatics in Africa

ISSN: 2197-6902
ISBN: 978-3-9816261-4-8
DOI: http://dx.doi.org/10.12856/JHIA-2015-v3-i2

Publisher
Koegni eHealth, Innovation for Development e.V. Germany
D-22071 Hamburg, Germany
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